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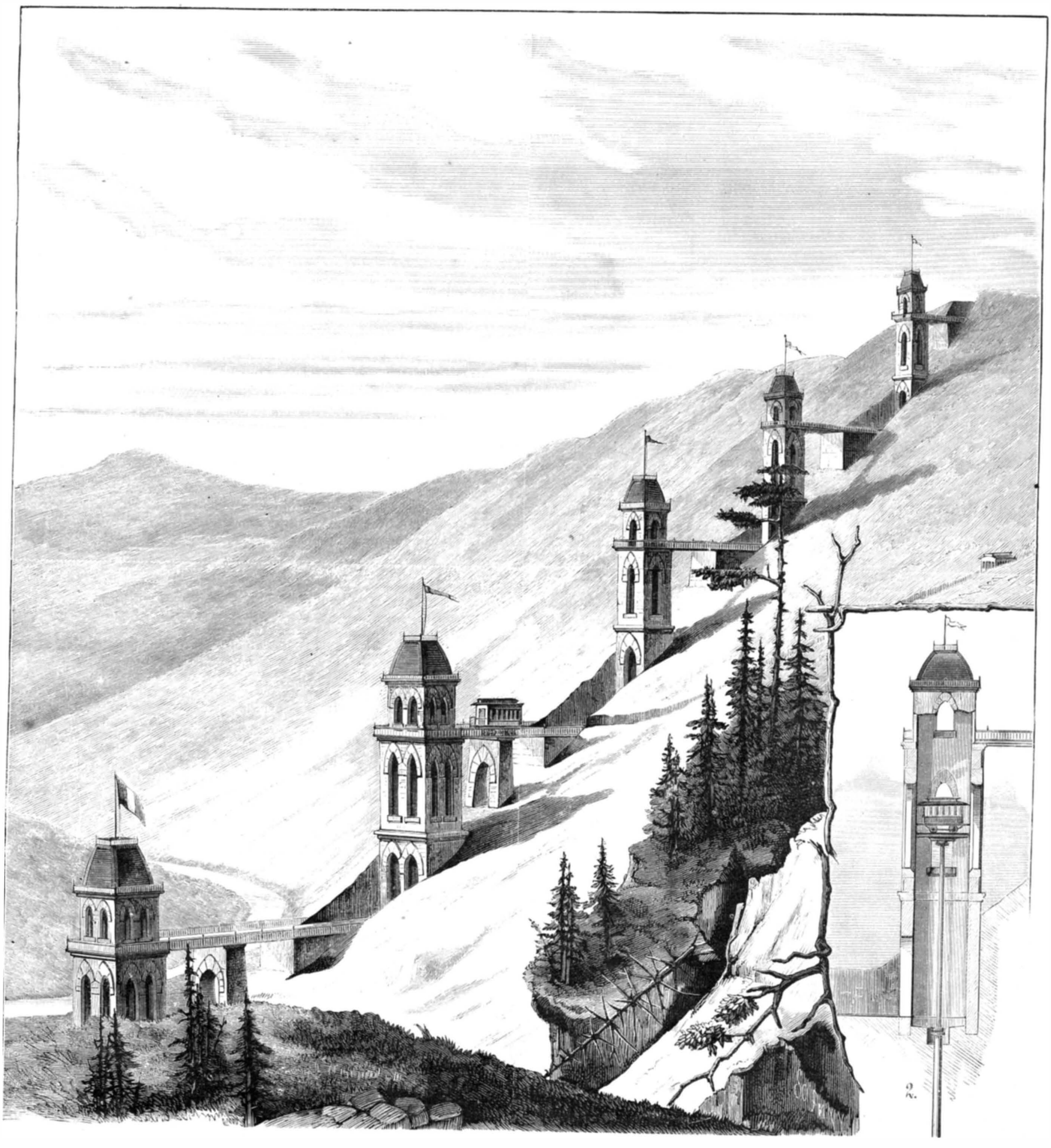
AN IMPROVED MOUNTAIN RAILWAY SYSTEM.

The construction, maintenance, and operation of mountain railways have long occupied the attention of engineers. Many methods of climbing steep inclines and of rounding curves of small radius have been proposed, and several of these methods have been reduced to actual practice. The systems of Fell and Riggenbach are very well known, and the ancient system of rope tramways is in use in many places. A distinguished engineer, M. L. Edoux, has conceived a project which is based upon the application of a system of hydraulic elevators to the lifting of cars to any height. This system may be applied to great advantage, when an abundance of water under high pressure is available. These conditions will be frequently met in a mountainous country. Although this project has not yet been realized it seems to possess sufficient merit and novelty to render it interesting to our readers. The illustrations have been specially arranged for the SCIENTIFIC AMERICAN from the author's plans, elevations, and sectional views.

The particular railway under consideration is intended to establish communication between Cauterets and the baths of La Raillère, France. Cauterets is situated in a narrow valley, at an elevation of more than 900 meters. It is a noted water-

[*Continued on page* 66.]



IMPROVED SYSTEM FOR MOUNTAIN RAILWAYS.

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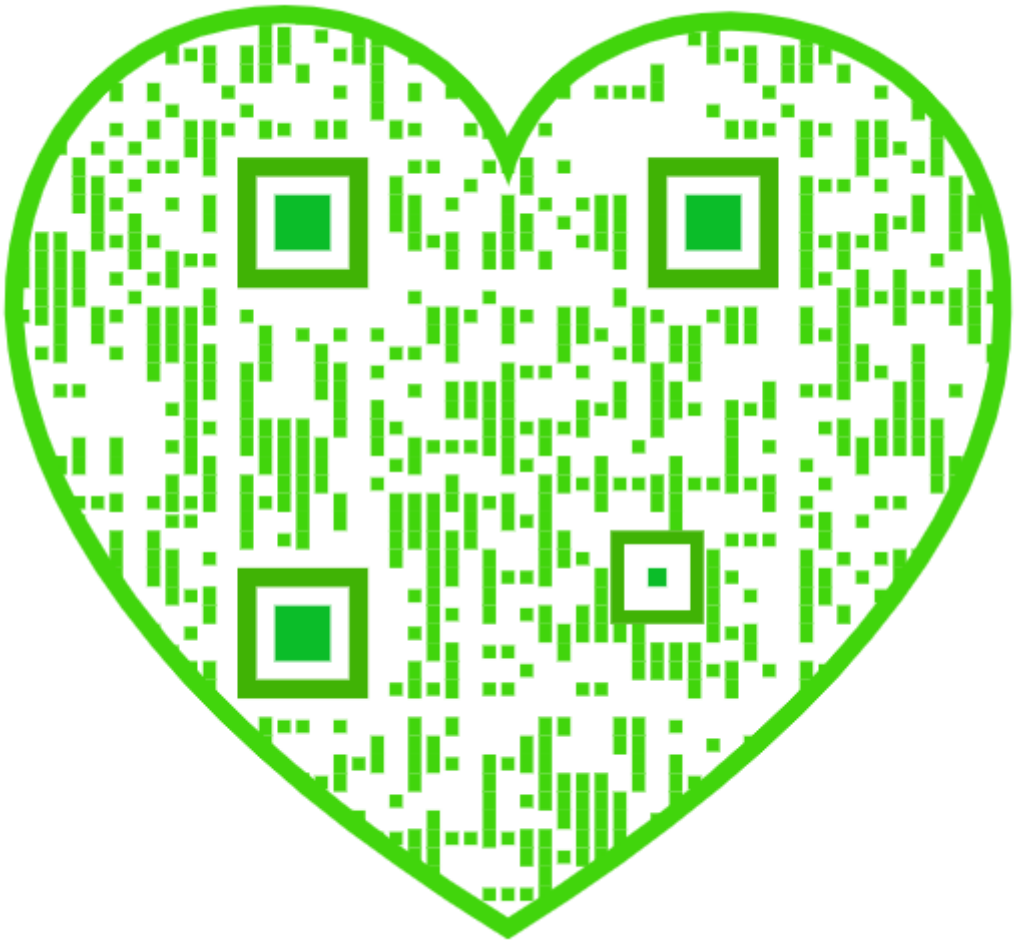

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THE TENDENCY OF RECENT COURT DECISIONS WITH REGARD TO REISSUED PATENTS.

The patent laws provide for the reissue and correction of patents when the original is inoperative or invalid by reason of a defective or insufficient specification, or by reason of the patentee claiming as his invention or discovery more than he had a right to claim as new, provided it is shown that the error arose from inadvertence, accident, or mistake, without any fraudulent or deceptive intention on the part of the patentee.

The matter to be introduced into the amended specification is limited strictly to such as was clearly indicated, described, or suggested in the original specification, drawings, or model, and such as might have been lawfully claimed, but was not, for the reasons mentioned.

The practice of the Patent Office has been less exacting on this point than the rules prescribe, so that in many cases the reissue specifications have contained substantially new matter; sometimes matter which the patentee might lawfully have inserted and claimed originally, but failed to, through ignorance or oversight, and sometimes matter which had been disallowed by the Office or voluntarily disclaimed by the inventor to secure the issue of his patent. By means of such reissues the inventor's afterthoughts and discoveries have been covered, and too frequently the subsequent inventions of others, or processes and machinery which others may have brought into profitable use, knowing them to be not patented. In this way much injustice has been wrought, and occasion given for many if not most of the more serious complaints against the patent system.

At first the courts were inclined to hold that the decision of the Commissioner of Patents in granting the reissue was final and conclusive, and could not be revised. More recently there has been a manifest disposition to go behind the Commissioner's action to inquire whether he may not have exceeded his jurisdiction or improperly performed his duty in granting a reissue for more than was covered by the original patent. Thus in the case of Leggett *et al. vs.* Avery *et al.* (U. S. Supreme Court, October, 1879), it was held that no error had arisen through inadvertence, accident, or mistake, but that the Commissioner had committed manifest error in allowing the reissue for more than was included in the extended patent, and for what was expressly disclaimed therein. In this decision Mr. Justice Bradley remarked that the allowance of claims once formally abandoned by the applicant in order to get his patent through is the occasion of immense frauds upon the public, and is to be discountenanced. In the same connection he said:

"It is doubtful whether a reissue patent can be sustained in any case where it contains claims that have once been formally disclaimed by the patentee, or rejected with his acquiescence in order to obtain his patent. In such case the rejection (omission) of the claim can in no just sense be regarded as matter of inadvertence or mistake, and even if it were such the applicant would seem to be estopped from setting it up on application for a reissue."

In the case of the Giant Powder Company *vs.* the California Vigorite Powder Company *et al.* (U. S. Circuit Court, District of California, October, 1880, Field, J.), the right of the court to review a decision of the Patent Commissioner was clearly stated. In this case a reissued patent was declared invalid because its specification contained an invention of broader scope than the original. The court said:

"As the power to accept a surrender and issue new letters is vested exclusively in the Commissioner of Patents, his decision in the matter is not open to collateral attack in a suit for the infringement of reissued letters. His action, like that of all officers specially designated to perform a particular duty of a judicial character for the government is presumed to be correct until impeached by regular proceedings to avail or modify it. He must judge, in the first instance, of the sufficiency of the original specification whether the same is defective in any particular, whether such defect was the result of an unintentional error, and if so, to what extent a new or additional specification should be allowed to describe correctly the invention claimed; and it is to be assumed in every case that he has done his duty. The decisions of the Supreme Court to this effect are numerous, and the doctrine is one of the settled rules of patent law. But it does not preclude the examination of the original and reissued patents, to see whether or not they disclose on their face a case in which the Commissioner had authority to act or whether he has exceeded his authority in issuing letters for an invention different from that described in the original patent."

The Commissioner's authority to reissue being limited strictly to those cases in which the original patent is inoperative or invalid from unintentional error, or where the inventor's claim exceeds his invention, the fact that the patent does not cover all that the patentee could have claimed if his specification had come up to his invention, furnishes no sufficient ground for a reissue.

"The statute authorizing a reissue," the court said, "was intended to protect against accidents and mistakes, and it is only when thus restricted that it can be regarded as a beneficial statute. If the patentee does not embrace by his specifications and claim all that he might have done, and there has been no clear mistake, inadvertence, or accident in their preparation, the presumption of law is that he has abandoned to the use of the public everything outside of them, or at least has postponed any additional claim for further consideration."

The same principle was laid down even more specifically by the United States Supreme Court, in the case of the Swain Turbine and Manufacturing Company, appellant, *vs.* Ladd. This was another instance of expanded claims in a reissued patent. The original specification was as perfect, so far as it went, as the new one, the pretended corrections having been introduced to widen the scope of the patent to give its owners a large and valuable monopoly of an important class of waterwheels. In the Circuit Court of the United States for the District of Massachusetts, the claims of the reissued letters patent had been restricted to the distinct limitation of the invention in the original patent, and that decision was sustained by the Supreme Court. In the opinion of the court, delivered by Mr. Justice Bradley, it was pointed out that "the mistake of the patentee or his assignees seems to have been in supposing that he was entitled to have inserted in a reissued patent all that he might have applied for and had inserted in his original patent. The appellants produced on the argument exhibits tending to show that the patentee before obtaining his original patent had made and done all those things which are embraced in or covered by the reissued patent. If this were true it would be nothing to the purpose. A reissue can only be granted for the same invention which was originally patented. If it were otherwise a door would be opened to the admission of the greatest frauds. Claims and pretensions shown to be unfounded at the time might, after the lapse of a few years, after a change of officers in the Patent Office, the death of witnesses, and the dispersion of documents, be set up anew, and the reversal of the first decision obtained without an appeal and without any knowledge of the previous investigation on the subject. New light breaking in upon the patentee as the progress of improvement goes on, and as other inventors enter the field, and his monopoly becomes less and less necessary to the public, might easily generate in his mind an idea that his invention was really more broad and comprehensive than had been set forth in the specification of his patent. It is easy to see how such new light would naturally be reflected in a reissue of the patent, and how unjust it might be to third parties who had kept pace with the march of improvement. Hence there is no safe or just rule but that which confines a reissued patent to the same invention which was described or indicated in the original."

If an unswerving adherence to this rule can be secured in the practice of the Patent Office it is obvious that a grave, perhaps the gravest source of objection to the patent system will be stopped. In the meantime the growing disposition of the courts to review the action of the Commissioner in reissuing patents, in cases of alleged infringement under them, and to construe the reissued patents rigorously, is a matter of much encouragement to manufacturers and the public at large.

OFFICIAL REPORT ON THE STEAMER ANTHRACITE.

We have received from the Bureau of Steam Engineering of the Navy Department, a copy of the full official report of the Board of U.S. Naval Engineers, relating to the tests of the machinery of the little British steamer Anthracite, made at the Navy Yard, Brooklyn, N. Y., August 13 and 14, 1880. The board was composed of three Chief Engineers of the U. S. Navy, namely, Chas. H. Loving, S. L. P. Ayres, and Geo. W. Magee, all gentlemen of ability and experience.

The Anthracite, it will be remembered, is an iron steamer, 86 feet 4 inches long, 16 feet 1 inch wide, 10 feet 2 inches deep, draught loaded, 9 feet. The total weight of engines, boiler, shaft, propeller, and all fittings was 25 tons. Her propeller was worked with three steam cylinders, the first, single acting, 7¾ inches diameter; the second, single acting, 15 1/16 inches diameter; the third, double acting, 22 1/16 inches diameter. Stroke of pistons, 15 inches. The most novel feature—the Perkins system—was the high steam pressure intended to be carried, namely, from 300 to 500 pounds to the square inch. The pressure now usually carried on the best sea going vessels rarely exceeds 75 to 80 pounds.

In a previous running trial of the Anthracite in England, by Mr. F. J. Bramwell, C.E., May 22, 1880, with a boiler pressure of 360 pounds, the total horse power per hour was obtained by an expenditure of 16,719·1503 units of heat F. (1·35 pounds combustible used).

In the Brooklyn trial, made with the vessel tied to the wharf and with a boiler pressure of 316½ pounds to the inch, the total horse power per hour was obtained by an expenditure of 20,498·22 units of heat F. (1·92 pounds combustible used).

Mr. Bramwell's results were 18·35 per cent more economical than the Navy Yard results. The reasons for this difference are clearly shown by our engineers to be due to the differences in the conditions of the two trials. Thus, the coal used by Mr. Bramwell was superior; he did not lose heat by throwing open the furnace doors to remove clinker; he carried a lower water level, and consequently superheated the steam more, and had less cylinder condensation; he carried a higher boiler pressure, and so obtained a higher initial pressure in the first cylinder, etc. If the proper calculated deductions for these differences in the conditions were allowed our engineers find that there would be a discrepancy between their results and those of Mr. Bramwell of only 4 per cent; they are further of opinion that the difference of the results was wholly due to the difference in the cylinder condensations; these being greater in the American trials gave poorer economic results. Our engineers speak very highly of the Perkins system, as shown by their trials of the Anthracite. They think that her successful passage of the

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Atlantic and the efficient condition of her machinery on arrival here ought to remove all doubt as to the practicability of the system.

THERMOMETERS.

The word thermometer means a heat-measure, hence any instrument employed to measure heat should be called a thermometer. When very high temperatures are to be measured, the instruments employed are called pyrometers, or measures of fire. Thermometers do not, of course, measure the quantity of heat in a body, but only tell us the relative temperature. There are several forms of thermometers, all based upon the principle that "heat expands, while cold contracts." Some substances expand unequally for equal increments of temperature, others expand so slightly that they fail to indicate small changes of temperature; both are unfitted for thermometers. It is believed that air expands equally for equal changes of temperature, and as this expansion is quite considerable (1-273d part for each degree centigrade), and as it does not become either liquid or solid under ordinary pressure, at any temperature which we can produce, it is the substance employed for the most accurate measurements of temperature. Any of the difficultly condensible gases, oxygen, hydrogen, marsh gas, might be employed instead of air, but with no advantage and with much inconvenience in their manufacture.

Next to air, the best material we have is mercury, which expands very evenly, does not freeze readily, and boils at a comparatively high temperature. For temperatures below —40° alcohol is generally employed, although it is claimed that glycerine could be used. For temperatures above 300° C. air thermometers alone are admissible; and for very high temperatures, where glass begins to soften, they are made of platinum.

The mercury thermometer, being the one usually employed in the arts, in meteorology, in medicine, and in other sciences, a few words in regard to the manner of making one may be of interest. A glass tube with a very fine bore has a suitable bulb, of any desired form, blown upon one end. At the other end may be a bulb of larger size, blown merely for convenience in filling. Neither bulb can be blown with the mouth, but with a bellows, containing pure, dry air. A small capsule is filled with pure mercury, which is heated to boiling to expel both air and moisture. While still hot the second or temporary bulb is warmed to expel a portion of the air therein; the open end is placed in the mercury, which ascends into the bulb because the air contracts on cooling. When a sufficient quantity of the hot mercury has been introduced into this bulb, the tube and the other bulb are heated to expel a part of the air, and some of the mercury, which must always be kept hot to prevent its chilling and thus breaking the hot glass, enters the real bulb. By repeating the operation the bulb and stem are completely filled with mercury, which is then boiled to expel every trace of air. The tube is now drawn out close beneath the auxiliary bulb to a fine thread and cut off; the thermometer is placed in a bath heated a few degrees higher than the highest temperature which the thermometer is to show; the excess of mercury flows out, and the point is closed with a fine blowpipe flame. As the mercury contracts on cooling it leaves a perfect vacuum above it.

The graduation is effected by putting it into ice or snow, then in the steam from boiling water, marking each of these points, dividing the space between into 100 parts if it is to have a Celsius or centigrade scale, into 80 if a Reaumur, or 180 if a Fahrenheit. This graduation is carried on in each direction to the end of the stem. On the Fahrenheit scale the freezing point is marked 32, on each of the other scales it is marked zero.

Absolute zero is a term applied to a temperature 273° below zero on the centigrade scale, or —460° Fah. If we take 273 cubic inches of air, or any gas, measured at 0° C., it will become 274 at +1° C., or 283 at +10° C., or 373 at +100° C., and at —10° C. it is only 263, at —40° it is only 233, and at this rate it should become only 1 cubic inch at —272°, and at minus 273° it should occupy no space at all, or at least not be a gas any longer. As this temperature is not yet attainable, we cannot positively assert that such would really be the case.

Maximum thermometers are made by placing a little float of steel upon the mercury, and the thermometer placed horizontally or nearly so. As the mercury expands it pushes along the float, which does not, however, follow the mercury when it contracts; hence we are able to ascertain the highest temperature reached during any given interval. To reset the thermometer it is raised to a vertical position and a slight tap given to it, which causes the float to drop down on the mercury again.

A simple and more accurate form of maximum thermometer, employed by Bunsen in measuring the temperature of the Geysers, consisted of an ungraduated thermometer open at the top, such as could easily be made by a person of but little experience. When placed in the spring, of course, a portion of the mercury would flow out and escape. At any subsequent time the thermometer could be placed in an oil bath beside a standard thermometer, and heated until the mercury had entirely filled the tube and was about to flow over; at this moment the standard thermometer is read, and shows the temperature to which the other thermometer had been exposed. The ordinary minimum thermometer contains alcohol instead of mercury, and the float is either of glass or of steel covered with enamel, so that it is drawn back by adhesion, but cannot be pushed forward.

The most reliable form of self-registering thermometer is an upright mercurial thermometer behind which is passed by clockwork a strip of sensitized paper. In front of it is placed a light of sufficient actinic power to blacken the paper above the mercury column. This gives not merely the maxima and minima but all variations of temperature.

Metallic thermometers may be constructed by combining two metals which expand unequally into a spiral, which winds up when heated and unwinds when cooled. One end of the spiral being attached to an index which passes along a graduated arc, the slight motions are magnified so as to be distinctly visible. It is graduated by comparison with a good mercurial thermometer.

For measuring slight changes in temperature a thermo-electric pile, connected with a galvanometer needle, is employed. This is only applicable within very narrow limits and requires great care to obtain satisfactory results.

E. J. H.

HYDRAULIC MORTARS AND CEMENTS.

Certain limestones, which contain upward of 10 per cent silica, possess the property, when burned, of forming a cement or mortar which hardens under water. Such limestone is called hydraulic lime, and the mortar is called hydraulic mortar. This stone, before burning, consists of a mixture of carbonate of lime and silica, or a silicate, chiefly silicate of alumina. The latter is insoluble in hydrochloric acid, hence remains undissolved when the stone is treated with this acid, but in burning this silicate is fluxed by the alkaline carbonates and becomes soluble in acid, the carbonic acid being expelled. When common lime is slaked it swells enormously and develops a great deal of heat; this is not the case in slaking hydraulic lime, which absorbs water without any considerable increase of temperature of volume.

If ordinary lime be mixed with a suitable quantity of silica or sand, an artificial hydraulic mortar is obtained, to which we apply the name of cement. These cements may be either natural or artificial. The former are found in volcanic regions, having been produced by the terrestrial heat. Pozzuolana, found at Pozzuoli, near Naples, is a natural cement of the following composition: Silica, 44·5; alumina, 15·0; lime, 8·8; magnesia, 4·7; oxide of iron, 12·0 (with oxide of titanium); potash and soda, 5·5; water, 9·3; total, 100·8.

The quantity of lime is, however, so small that it requires to be mixed with ordinary lime to form hydraulic mortar. It was employed in combination with an equal quantity of lime in building the Eddystone Lighthouse.

Artificial cement, also called "Roman cement," because it is *not* made in Rome, has been manufactured in England on the Thames and in the Isles of Wight and Sheppey since 1796. It is made by burning the calcareous nodules which overlie the chalk in that country. A sample analyzed by Michaëlis contained: lime, 58·38; magnesia, 5; silica, 28·83; alumina, 6·40; oxide iron, 4·80. When mixed with water it hardens in fifteen or twenty minutes, and possesses great firmness and strength.

Portland cement was patented in England by Joseph Aspdin in 1824. He took the limestone of Leeds, pulverized and burned it, then mixed it with water and an equal weight of clay to a plastic mass. When dry this was broken up and burned again until all the carbonic acid was all expelled. It was then pulverized and was ready for use. Pasley made it from chalk or limestone with Medway River clay, which contains salt. Pettenkofer suggests that cement is improved by soaking the clay in salt water.

Portland cement is now made, says Wagner, by making bricks of an intimate mixture of limestone and clay, drying them in the air and burning them in a tall shaft furnace from 45 to 100 feet, 12 feet in diameter, with a strong grate 4 feet from the bottom. It is charged with alternate layers of coal and cement stone. The properties of the cement are largely dependent on the temperature employed in burning; a white heat is best, but if the temperature is too high it will no longer unite with water, and may even be melted to a glass. If the temperature does not exceed a red heat it unites readily with water and gets hot, like ordinary lime, but possesses very little strength. The color changes with the burning and forms a criterion for judging the quality. In normal condition it forms a gray, sharp powder, with a shade of green, but not glassy.

The manufacture of Portland cement is now carried on in every part of the world where limestone and clay are to be found. In order to obtain a good cement, not only must the proper heat be employed in burning, but the proper proportion of clay, usually 25 per cent, must be used, and the clay must have certain properties, such as a large proportion of silica, must be very finely divided, and must be very intimately mixed with the limestone. Analyses of Portland cement from various sources show the percentage of lime to vary from 55 to 62; silica, 23 to 25; alumina, 5 to 9; oxide of iron, 2 to 6; soda and potash, usually less than 1 per cent.

A calcareous marl found near Kufstein forms a natural Portland cement on burning without any other admixture. The analysis shows that it contains 21·77 per cent of insoluble substance containing 16 per cent of silica. The portion soluble in hydrochloric acid consists of 70·64 carbonate of lime; 1·02 carbonate of magnesia; oxide of iron, 2·58; alumina, 2 86. These figures lead us to expect that a marl containing from 20 to 25 per cent of insoluble matter, with 70 of carbonate of lime, will probably furnish a good cement when burned. The presence of much magnesia seems to have in all cases an injurious effect; all excellent hydraulic lime contains very little magnesia.

Erdmenger, who has studied the constitution of Portland cement very carefully, concludes that it is not a definite chemical compound. He considers it rather as water glass, in which the alkali is replaced by lime.

A consideration of the use of Portland cement in the manufacture of artificial stone would exceed the limits of our present article.

H.

GENERAL GRANT AS PRESIDENT OF THE WORLD'S FAIR COMMISSION.

General Ulysses S. Grant was chosen permanent President of the World's Fair Commission, at a meeting of the Commissioners held in this city January 13. It was announced that he had consented to serve.

General Grant's ability as an executive officer is known the world over; and probably no other name would have carried so much influence at home and abroad. With a leader so well known, popular, and capable, the Commission should be able to raise promptly all the money needed to secure at Inwood, in 1883, an exhibition worthily representing the progress of the world since 1876.

SOLAR CLOUDS AND SUN SPOTS.

Some recent studies of solar spectra in connection with sun spots and other features of the sun's envelope have led Mr. Charles S. Hastings, of the Johns Hopkins University, to form a somewhat novel theory of the sun's constitution and the conditions producing the more notable phenomena familiar to solar students.

Mr. Hastings finds, contrary to the received opinion, that the spectra of the center and the outer edge of the sun's disk are not precisely alike, though the differences are so minute as to escape all but the most perfect instruments and all methods which do not place them in close juxtaposition. Certain of the Fraunhofer lines, the thickest and darkest in the spectrum, notably those of hydrogen, magnesium, and sodium, which appear with a haze on either side in the spectrum of the center of the solar disk, are sharp and distinct in the spectrum of the limb. Certain very fine lines are stronger at the limb, while other very fine lines are stronger at the center. The ordinarily accepted theory of the solar constitution and the origin of the Fraunhofer lines fails to explain these phenomena. The probable reasons for this failure Mr. Hastings discusses at considerable length in the January issue of the *American Journal of Science*, and then proceeds to frame a theory of the sun's constitution, which, he thinks, will satisfactorily explain all the observed phenomena. The limit of our space forbids more than the briefest summary of his conclusions.

His theory differs from that of Faye chiefly in localizing the phenomena of precipitation instead of regarding it as proper to all portions of the photosphere, and in supposing the precipitation confined to one or two elements. He attributes the granular appearance of the solar surface to ascending currents directed generally from the center of the sun. About these currents are necessarily currents in an opposite direction, which serve to maintain a general equilibrium in the distribution of mass. The ascending currents start from a level where the temperature is probably above the vaporizing temperature of every substance. As they move upward the vapors are cooled, mainly by expansion, until a certain element (probably of the carbon group) is precipitated. This precipitation, restricted from the nature of the action, forms the granules. The precipitated material rapidly cools, on account of its great radiating power, and forms a fog or smoke, which settles through the spaces between the granules till revolatilized below. It is this smoke which produces the general absorption at the sun's limb, and the "rice grain" structure of the photosphere. The reasons for supposing the precipitated element to be of the carbon group (carbon or silicon) is simply that no other substances present the properties indicated by the cloud masses of the photosphere. It is pretty clear that the substance has a boiling point above that of iron, for iron vapor at a lower temperature exists in its immediate neighborhood. The element is not a rare one, and its molecular weight cannot be great, for though precipitated below the upper natural limit of its vapor there are few elements found in abundance above it, and those in general of low vapor density. It is possible that the light coming from the sun is radiated from solid or liquid particles of carbon just at the point of vaporization; but Mr. Hastings is rather inclined to suspect that the photospheric material is silicon. There is also good reason to suppose, he thinks, that carbon is precipitated at a higher level, possibly along with the less common element boron.

The clouds of carbon or other smoke would naturally be drifted into spaces of downward flowing currents, thus forming sun spots, the characteristics of which are readily accounted for by the necessary behavior of smoke clouds sinking into regions of higher temperature. This explanation of sun spots and their allied phenomena is certainly plausible, and we shall look with interest for what older students of the sun shall have to say about it.

THE MATANZAS INTERNATIONAL FAIR.—Mr. Benjamin Giberga, general agent for the United States of the approaching Cuban World's Fair, announces that the opening day has been definitely fixed for February 10, 1881.

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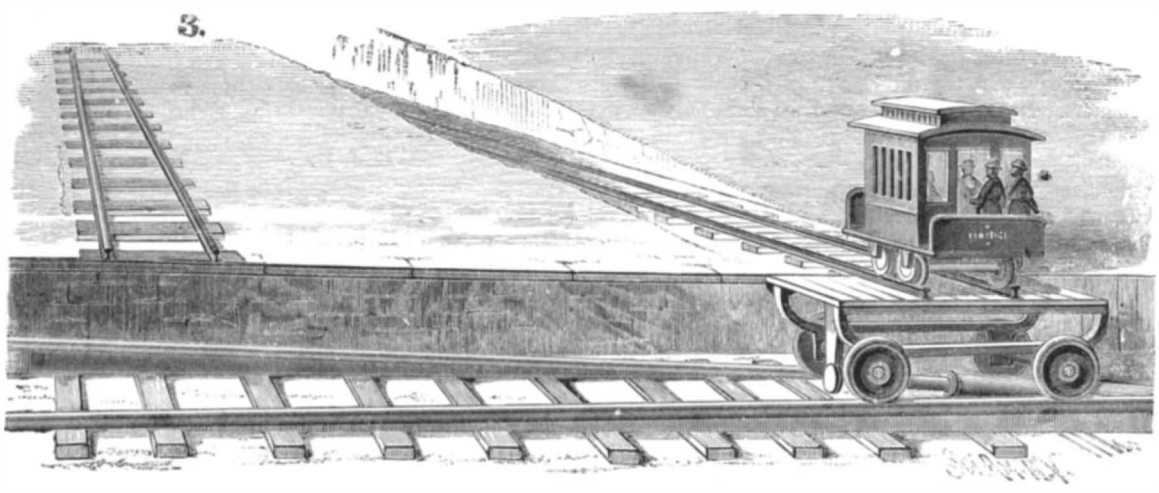
AN IMPROVED MOUNTAIN RAILWAY SYSTEM.

[*Continued from first page.*]

ing place, and during the season is filled with numbers of invalids, who go there in search of health. The hot sulphur springs for which this region is noted, are located at La Raillere, 125 meters higher up the mountain, and more than 915 meters distant.

To travel over this fatiguing route, to go and return, often twice in the same day, in the capricious weather of the mountains and in the crowded omnibuses, is uncomfortable and even dangerous for infirm persons. The waters cannot be conveyed from La Raillère to Cauterets without modifying their temperature and their chemical composition to which their therapeutic properties are due. It is, therefore, necessary to convey the sick to the springs that they may receive the full benefit of the water. This railway has been projected for the purpose of conveying the bathers from Cauterets to La Raillère rapidly and comfortably.

All systems, with the exception of that of M. Edoux, require the consumption of a large amount of fuel, which in this region is very expensive. This inventor utilizes the powerful waterfall at La Raillère, which, in connection with gravity, constitutes the motive power of the railway.



MOUNTAIN RAILWAY SYSTEM.—TRANSFERRING THE CAR.

The mode of operating the railway is as follows: The car is raised vertically by means of hydraulic elevators to a greater height than its destination, which. in the present case, is La Raillère, and is then allowed to descend as far as that place by its own gravity upon an inclined railway. To return, the car is transferred by its own gravity to a second railway inclined in the opposite direction. The cars are provided with efficient brakes, by means of which the speed may be effectually controlled.

In practice, the car is not raised the vertical distance of 125 meters at a single lift, but this distance is divided into five parts of 25 meters each. There are five towers at intervals of about 40 meters. In each one is placed a hydraulic elevator, similar to those introduced by M. Edoux into the hotels and houses of Paris. The top of each tower is a little more elevated than the foot of the next one, and is connected with it by an inclined bridge. The car is raised by the hydraulic elevator to the top of the first tower, runs by its own gravity to the base of the following one, is raised to the next level, and so on. Together they form a gigantic staircase with steps 25 meters high. The last landing place is 135 meters above Cauterets.

The return way, which is on the side of the mountain, terminates in the second tower. The cars descend vertically only in the first two towers, which contain two compartments, one for hoisting the car and one for lowering it.

At La Raillere the inclination of the car is reversed, and the car is transferred to the return track by means of a platform supported on wheels and provided with rails. The car on arriving from Cauterets rolls upon the platform. The latter moves by its own gravity on rails slightly inclined in opposite directions (see Fig. 3), so that when the rails of the platform join the return track their inclination will have been reversed, and the car will, of its own gravity, return to the second tower. The movement of the transferring car is controlled by a hydraulic piston. The gradient of the railway to La Raillere is 0·005125 per meter, and of the return road 0 043961 per meter.

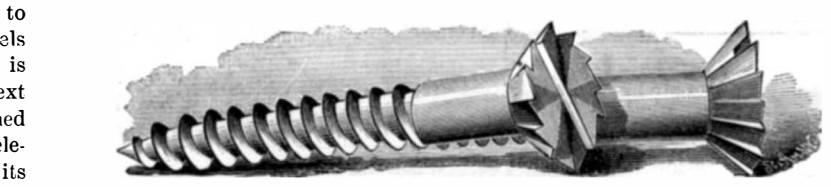
The department engineers prefer this plan to all others. The question of construction will be taken up at the next session of the Chambers.

NEW MECHANICAL MOVEMENT.

The engraving represents a novel mechanical movement for converting a continuous rotary motion into an intermittent rotary motion. The driving shaft carries a triple sprocket wheel, which is keyed on or otherwise fastened, and the driven shaft has three sprocket wheels, two of which are secured to it, while the third is movable on the shaft. The endless chain which connects the chain wheels of the two shafts is made of three separate sections —a median section alternating with two outer sections arranged parallel to each other and separated by a space equal to the width of the openings in the narrower section. This chain thus formed, as will be noticed, is double for a portion of its length, while the remainder is single.

When the driving shaft is revolved the chain is carried forward at a regular rate of speed. When the single portion of the chain comes into contact with the loose central sprocket wheel on the driven shaft, only the loose wheel is revolved, the shaft remaining stationary; but when the double portion of the chain engages the outer wheels, which are fixed on the driven shaft, the shaft is revolved until the double portion of the chain has passed over it, when it rests until engaged by another double portion. By means of this ingenious contrivance the driven shaft may be rotated either regularly or irregularly according to the relative proportion of double and single chain. This movement should find a ready application in textile machinery, and in fact in all classes of machines where intermittent rotary motion is employed.

This invention was recently patented by Mr. William P. Drew, of Preston, Minn.



ECKFORD'S IMPROVED WOOD SCREW.

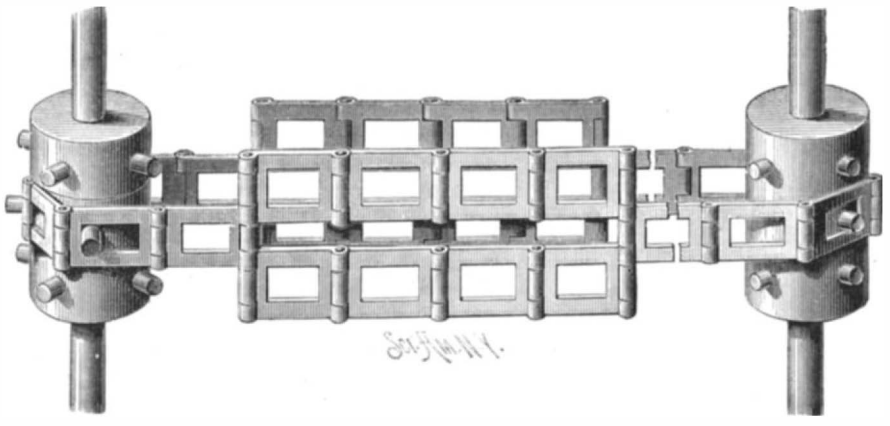
IMPROVED WOOD SCREW.

The engraving shows a self-countersinking wood screw, recently patented by Mr. John Eckford, of San Antonio, Texas. It will work in all kinds of wood, and clears itself of the chips made in boring. The screw has on the underside or bevel a series of bits or cutting edges alternating with deep interspaces, which completely fill the under surface of the head. These notches increase in width and depth from the screw shank to the crown of the head. This form allows the chips to escape readily.

The cutters are formed on the screw head by forcing it while hot into suitable dies. In other respects the manufacture of this screw does not differ from that of the common form. In use, this form of screw saves a great deal of time and insures a good fit between the head and the wood in which it is bedded.

RECENT INVENTIONS.

An adjustable tension, with sufficient power for springs for folding or cabinet bedsteads, is secured by a spring patented by Mr. Herman A. J. Rickett, of New York city. This is a spiral spring sustained at one end and having a shaft connected with the opposite end and extending through the coil. On the free end of the shaft is a drum on which winds a belt extending to and connected with the hinged bed. Two of these arrangements for each bed are preferably used. The tension of the spring can be adjusted by shortening the belt.



DREW'S MECHANICAL MOVEMENT.

A rotary engine, patented by Mr. Gabriel Jasmagy, of Brooklyn, E. D., N. Y., is a cylinder with interior slotted cylinder half the diameter of the exterior cylinder, mounted on shaft journals in the end pieces of the outer cylinder. The slotted cylinder has overlapping sliding piston plates provided at the ends with a pin and pivoted curved guide bar fitting in an annular groove on the inside of the end pieces of the outer cylinder, which devices draw the piston plates inward and outward, forming a piston of variable size as the shaft rotates.

An improved machine for packing boned hams and shoulders has been patented by Mr. William Hoefjen, of New York city. The invention consists of a cylindrical receptacle, the upper half of which is pivoted on its longitudinal edge and is provided with a lever lock, by means of which the lid can be gradually closed, compressing the meat in the cylinder; the meat is then further compressed by closing the front of the cylinder by means of a suitable disk and driving a piston forward, after which the disk at the front of the cylinder is removed, and an envelope of suitable material is drawn over the front of the cylinder; into this envelope the meat is forced by the piston.

A gate that may be opened by an approaching vehicle or by a person on horseback without dismounting, and closed in the same manner, has been patented by Mr. Nathan Scarritt, of Kansas City, Mo. The invention consists of a gate made in two like sections that are pivoted on horizontal axes, and of novel mechanical devices for operating the gate sections.

A simple and amusing game that can be played by any desired number of persons, and does not require any special skill to understand its operation, has been patented by Mr. Niels C. Larsen, of New York city. The invention consists of a spirally-grooved cone contained within a figure with an aperture in its upper part, which figure rests upon a flat conical base having a spiral groove provided with a series of numbered recesses in its upper surface, so that a small ball that is passed into the aperture of the figure will run through the spiral grooves of the cone and along the spiral grooves of the base, and will finally stop in one of the numbered recesses a greater or less distance from the end of the spiral.

Mr. George O. Keiter, of Spring City, Pa., has patented a meat and vegetable cutter so constructed that the substance to be cut is fed to the cutter automatically. The cutters can be adjusted to cut thicker or thinner slices, and can be used to slice substances smaller than the cavities of the feed boxes.

An improved copybook, which prevents the scholar from copying his own writing as he approaches the bottom of the page, and enables him to see and study the original copy very distinctly, has been patented by Elmer P. Newman, of Dimondale, Mich.

A sand guard for car axle boxes, patented by Mr. Henry Roth, of New York city, consists in a band fastened upon the inner end of the journal box, and open at the lower side. The opening in the inner end of the box is thus protected from sand.

A fire escape, patented by Messrs. Eduard Kamin and Heinrich Egberts, of Bremen, Germany, seems to be simple, compact, and reliable. It is of the life rope variety. The velocity of descent is regulated by a vibrating balance mechanism

Mr. Gorham N. Winslow, box 290, Newton, Mass., has patented an improved velocipede or tricycle in which the driving wheel is propelled by hand power, connection being made between the crank shaft and drive-wheel shaft by a shaft and bevel gearing.

An improved glass button and a mould for attaching the eye thereto, has been patented by Mr. August Hamann, of Hoboken, N. J. In this improved button the strain upon the eye is distributed through the cap, which is firmly attached to the glass at all parts of the circumference of the cap.

Mr. Erwin B. Newcomb, of Cumberland Mills, Me., has patented an improved machine for winding paper and similar materials from a loose condition into hard rolls, especially materials of a brittle nature—such as, for instance, enameled paper, which is usually wound by hand on account of its liability to curl at the edges and become broken.

A device for stretching and smoothing thread, more especially of silk in twists, sewings, embroidery, organzine, and tram, has been patented by Messrs. Lewis E. Leigh and Lewis Leigh, of New Haven, Conn., whereby through special construction of the bobbin stand and cap and correlated appliances, an even tension of any desired degree upon all threads in the different processes of manufacture is secured.

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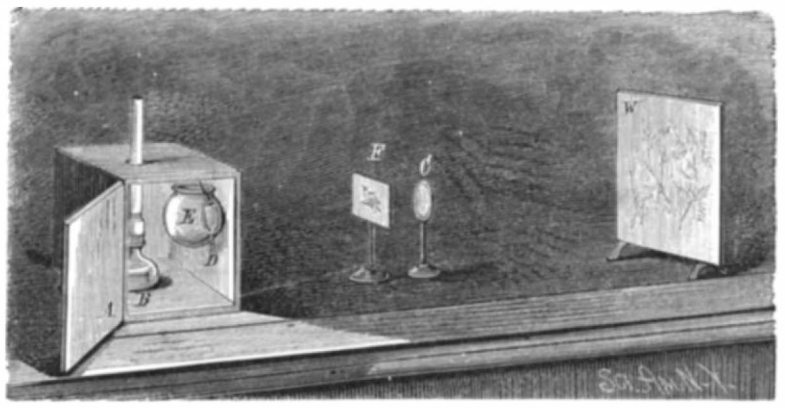
SIMPLE MAGIC LANTERN.

All that is required for this apparatus is an ordinary wooden packing box, A, a kerosene hand lamp, B, with an Argand burner, a small fish globe, and a burning glass or common double or plano-convex lens, C. In one end of the box, A, cut a round hole, D, large enough to admit a portion of the globe, E, suspended within the box, A, with the lamp, B, close to it. The globe is filled with water from which the air has been expelled by boiling.

Now moisten the surface of a piece of common window glass with a strong solution of sulphate of soda, or even common table salt, dissolved in water, and place it vertically in a little stand or clip, as shown at F, so that the light from the lamp, B, will be focused on it by the globe, which in this case answers as the condenser. The image of the glass will then be projected on the wall or screen of white cloth, W, providing the lens, C, is so placed in the path of the rays of light as to focus on the wall or screen. In a few minutes the salt solution on the surface of the glass, F, will begin to crystallize, and as each group of crystals takes beautiful forms, its image will be projected on the wall or screen, W, and as it is watched it will grow, as if by magic, into a beautiful forest of fern-like trees, and will continue to grow as long as there is any solution on the glass to crystallize. Then, by adding a few drops of any of the aniline colors to the water in the globe, the image on the screen will be illumined by shades of colored light.



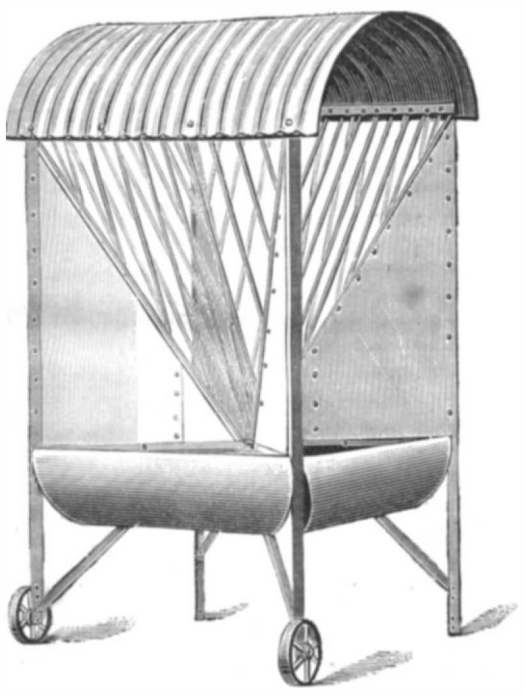
SIMPLE MAGIC LANTERN.

Powerful Pumping Machinery.

The San Francisco *Bulletin* announces the completion at the Risdon Iron Works of the largest pumping engine ever built. It is to be used in draining the Chollar, Norcross, and Savage shafts of the famous Comstock mines at Virginia City, Nevada. The engine occupies a space 65 feet by 20 feet, and weighs between 200 and 300 tons, which the underground machinery will increase to about 1,000 tons in all. The engine accumulates water at 1,000 pounds pressure to the square inch, in a reservoir at the surface 60 feet high, from which it will be conducted by a pipe 2,400 feet to the bottom of the shaft, there to operate a pump which will raise the seepage water 800 feet to the Sutro Tunnel, into which it will be discharged. The water which does the work returns to the surface by another pipe. The system can be extended to 3,000 feet in depth, or take water from mines half a mile away, simply by extending the pipes. The new system is intended to dispense with the heavy and cumbersome pump rods heretofore used. The engine is compound, with the Davey differential valve motion.

IMPROVED CATTLE FEEDER.

The engraving shows an improved cattle feeder invented by Mr. Wm. Griffiths, of Shrewsbury, England. It consists



GRIFFITHS' CATTLE FEEDER.

of four triangular troughs with racks above, fitted to a square frame having T-section iron uprights supporting a curved corrugated roof, troughed at the eaves for carrying the rain water to the corners. The racks run up from the center of the troughs to each upper angle, forming a triangle. It is fed from either end of the roof, and will hold as much fodder as a man can carry. The whole structure is of iron and mounted on wheels, two of which can be locked at pleasure should it be desired to make it a fixture.

TO DEADEN THE NOISE OF HAMMERING IN SHOPS, it has been suggested to place rubber cushions under the legs of the work-benches. We have found wool, felt, or any very thick loosely made woolen texture a much better material for this purpose than rubber. Pieces suitable for these pads can ordinarily be selected from tailors' clippings, and may be had for little or nothing.

An Interesting Railway Relic.

One of the most interesting relics we have seen in some time is a page from a Boston paper of 1825, containing a picture of the "Hetton Railroad," as designed by William Strickland, Esq., civil engineer. The stupendous line was to be seven miles five furlongs in length, and was to extend from the Hetton collieries, in England, to the town of Sunderland, on the River Wier. From the picture and the accompanying description, we find this railroad climbing hill and descending dale, and making no attempt to follow any grade. Several stationary engines are used to transport the coal wagons over these irregularities of the surface, and finally a locomotive, made of thick sheet iron, weighing five tons and possessing twelve horse power, takes them in tow and pulls them to Sunderland. These locomotives are able to pull ninety-ton trains.

Below the general view of the road is a cut representing a train. The engine is neither a graceful nor a complicated affair, and consists chiefly of boiler, smokestack, and piston. There is no cab for the engineer, who stands on a platform beside the boiler and takes the weather as it comes to him. The tender is equally primitive in its construction, and appears to be about the size of an ordinary box wagon. The coal carts look very much like the bobtail dumps of the present day.

The letter-press on this page contains a description of the Hetton Road; a general article on the value and utility of railroads; an extract from a letter from Hon. De Witt Clinton, comparing railroads with canals to the former's injury, and a series of answers to questions respecting railroads by Thomas Tredgold, an English civil engineer, who was advanced enough in his ideas to believe in railroads. The entire page shows that it appeared at a time when the question of railroads *vs.* canals was being agitated. The great expense of the former seemed to be the chief difficulty in the minds of the canal advocates, who could not realize the enormous profits which would go to pay those expenses and enrich railroad men to boot. Governor Clinton's arguments are rather amusing in the light of our present railroad facilities.

The relic is weather-stained and exceedingly old-fashioned in appearance. It is the property of Mr. F. H. Munsell, of the Central. And when we look at this picture and think of the great four-track line it seems as if the relic must be a thousand years old. One cannot believe so much had to be learned in the space of fifty-five years.—*Buffalo Courier.*

Apprentice System Reviving.

We are pleased to see that the Ames Manufacturing Company, of Chicopee, Mass., are doing something toward a return to the old apprentice system. The company have been very much troubled to get skilled help, and also by having men leave after they have learned enough to begin to be useful. They have now adopted a plan something like the former system, only the term of service is not more than three or four years instead of seven, and they are overwhelmed with applications. The men sign a contract to stay to the end of the term, and the company will teach them the different branches of the business, so that when they go out they will be masters of the trade instead of knowing how to run but one machine or to do one particular kind of work. The company keep 10 cents a day from their pay until it amounts to $100, which is given to them at the end of the apprenticeship.

The Yield of Wheat.

To test the bearing qualities of the leading varieties of wheat the Superintendent of the Ohio Agricultural College Farm sold seed wheat to farmers in various parts of Ohio and other States, requesting report of yield from each. The results are shown in the following comparison: Fultz, 24 reports average 25¾ bushels; Clawson, 10 reports average 23¾ bushels; Silver Chaff, 15 reports average 26¼ bushels; Velvet Chaff, 11 reports average 26 bushels; Gold Medal, 12 reports average 21⅔ bushels; Sandomicka, 7 reports average 24½ bushels.

Porcelain Manufacture in New Orleans.

A happy coincidence of enterprise and discovery has just occurred in the South. While Mr. Surgi, of New Orleans, was arranging for the setting up of a porcelain factory in that city, expecting at first to import the kaolin to be used, the Assayer of the Mint received from Texas, for analysis, samples of clay which proved to be kaolin of the finest quality. The deposit had been known for some time, but nothing had been done with regard to its development. The announcement of the proposed porcelain factory called the attention of the owners of the deposit to its possible value, and the two interests have recently been brought together. The kaolin occurs near Bremond, Texas, where a bed of eighty acres or more lies close to the surface. The depth of the deposit is not given.

Water Cresses in Winter.

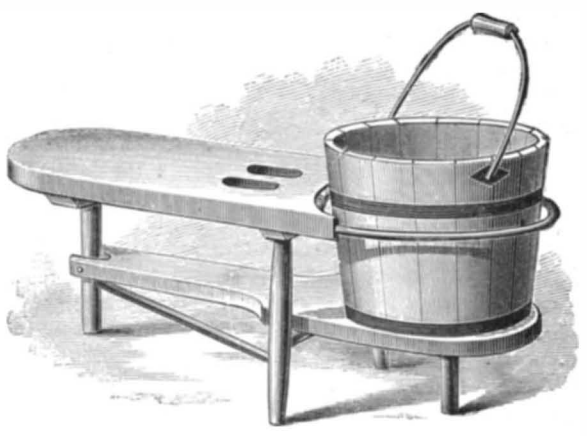
The *Gardener's Magazine* thinks that many of the writers in the horticultural papers do not know that frost kills water cresses. The delectable *Nasturtium officinale* is properly classed as a hardy plant, for it takes care of itself as a weed, and who, therefore, shall accuse it of tenderness? Where cresses are fast rooted and flourishing in a brook or any other water, it will be found that after a coat of stout ice has been formed the crop is gone entirely. That is to say, all the succulent leafy stems that might have been cut before the frost came have been destroyed by ordinary freezing, if only to the extent of about seven to ten degrees. It follows, therefore, that to preserve cresses for winter use anywhere out of doors shelter of some kind is necessary. There are many ways of doing this. It is not unusual for the market growers to let in a flood of fresh water when a sharp frost is expected. This covers the plants, and the ice is formed so far above them that they escape its effects. Another plan is to lay planks or tree loppings over the bed, and rough contrivances of this kind will carry a crop through a moderate frost, but a continued and severe frost will find its way through such penetrable stuff. Where it happens to be convenient, a frame is the best protection, and those who have to supply the table plentifully in winter would do well to arrange their plans with a view to the use of frames ultimately. That many who should know do not know that frost is destructive in its effects on cresses is not surprising, because hitherto the subject has but rarely obtained any special attention.

Glass Making in Ohio.

Five new glass works were started in Ohio last year, and several more will be added this year. The latest official statistics give 19 firms employed in glass manufacture, with 32 furnaces, having 292 pots and employing 2,032 men. In the production of window glass there are employed 7 furnaces, with 66 pots; flint glass, 19 furnaces with 199 pots; green glass, 4 furnaces with 27 pots. The glass works are in Bellaire, Columbus, Ravenna, Kent, Zanesville, Steubenville, Martin's Ferry, Bridgeport, La Grange, and Newark.

NEW MILKING STOOL.

The combined milking stool and pail holder shown in the engraving is the invention of Mr. G. W. Williams, of Eau Claire, Wis. The seat or stool carries a support for the pail, and is provided with a circular guard rail for retaining the pail in its position. There are two apertures in the seat



IMPROVED MILKING STOOL.

forming a handle by means of which it may be easily carried. The pail support is pivoted and is capable of moving up or down to accommodate itself to inequalities in the ground surface.

Hard Soap by a Cold Process.

Mr. R. F. Fairthorn, Ph.D., has contributed the following recipe to the *Druggists Circular:*

A good hard soap can be easily produced if four pounds of olive or sweet almond oil mixed with two pounds of soda lye, of the strength 36° Baume, are stirred until of the consistence of thick paste, when it should be poured into moulds, covered by several folds of muslin, and kept in a warm room for twenty hours. By this treatment the process of saponification, or union of the acids in the oils with the alkali, is complete. When these materials are first mixed the temperature of the mass rises, and in order to effect the entire union of ingredients so as to form the compound called soap, it is necessary that the heat thus generated should be maintained for some time, hence the necessity for covering the moulds and keeping them in a warm room.

He has found that it is desirable to use oil that is slightly rancid, or, if free from rancidity, to add about ten per cent of oil that has become so. Oil that is perfectly sweet requires two or three days to effect saponification.

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Correspondence.

Dangers of Electric Light Wires.

To the Editor of the Scientific American:

Absence at sea prevented me noticing sooner your observations on the death of the fireman on board the Livadia, who was killed by an electric light current. If not too long behind the time of the occurrence, I would like to add my experience on the subject, in connection with Siemens machines, which you presume would be equally dangerous under the same conditions.

I have myself received the current capable of giving four lights (each of 400 candle power) through the legs, trunk, left arm, thumb, and one finger, between which I had caught a wire. I do not say I liked the sensation, but could have endured it if necessary; the finger and thumb were rendered incapable of motion, and the wire was so firmly held by them that it took a good tug to drag the wire through by main force. The only resistance the current had to overcome was my shoes and some damp boards.

In another case I know of an operator who inadvertently took a wire in each hand, thus completing *across his chest* a current of same strength as in my case, but without any harm resulting. The muscles of the hand were strongly contracted, and he was unable to call out for help, although he was perfectly conscious it was close at hand; but by walking back until he could exercise a strain on the wires he dragged them from between his fingers as I did. This, I think, shows that currents such as are generated in Siemens machines are incapable of causing death to a person *not affected* with heart disease. If, however, passed through the brain or spine it might be more serious, possibly resulting in temporary unconsciousness.

As the Livadia's fireman seems undoubtedly to have been killed by the dynamo current, I can only suppose that the machines there used were constructed to give currents of high tension for sake of getting a considerable number of lights on one circuit.

Perfect insulation of the leads throughout the *entire* circuit should be deemed a necessity, especially in a ship or other structure of iron. This is best done by using covered wire, *not omitting to cover* any joints that may be made.

Your suggestion about protecting the lamps and terminals is a very good one, even where the insulation of the leads has been attended to, for the reason that a man in renewing the carbons may be up a ladder or in a position from which he might easily fall in case he got even a slight shock, which by startling him might cause him to lose his balance. I think it is better that the exact amount of danger attendant on any system may be known, so that it may be guarded against and so avoided, and also to prevent those who otherwise could inform themselves from forming exaggerated notions of what that amount really is

J. W. L.

S. S. City of Berlin, Pier 37, New York.
January 5, 1881.

The New Comet Pennule.

To the Editor of the Scientific American:

Telegraphic announcement was received by me December 17, 1880, of the discovery of a new comet by Pennule at Copenhagen, Denmark, on the 16th ult. Dense clouds prevented any observations of the object until the evening of December 31, when in a very few minutes I picked up the comet and secured a good observation. It was at discovery in right ascension 18 hours 49 minutes; north declination 10 degrees 35 minutes. When observed by me on the 31st, it was, by estimation, in right ascension, 19 hours 47 minutes; north declination 19 degrees 30 minutes. This brought the comet about midway on a line drawn from Albireo in Cygnus to Epsilon Delphinus—the last star in the tail of the Dolphin. Good observations were also obtained on the two following evenings.

The motion of the comet is northeast something more than one degree daily; so that its position is improving, and being quite a bright telescopic comet, it may be readily seen in moderate telescopes for some time. The present direction of its motion is toward Zeta Cygni.

It is nearly 3 minutes of arc in apparent diameter, has a considerable condensation not quite central, but no tail.

WILLIAM R. BROOKS.

Red House Observatory,
Phelps, N. Y., January 4, 1881.

Cutting Hard Steel with Soft Iron.

To the Editor of the Scientific American:

About forty years ago, having often heard that hard steel could be cut readily with a circular disk of sheet iron when driven at a high motion, I made a disk about ten inches in diameter out of a piece of heavy stove-pipe iron, having a round eye at the center about one and a half inches in diameter. I then put a stick of hard wood in the turning lathe, turned it off true, making a wooden mandrel for holding this iron disk, just as a circular saw is held true on a metallic mandrel. The periphery of the disk, after it was secured to the wooden mandrel swinging in the lathe, was ground and filed until it would run as true as a millstone. The disk was secured to the collar or shoulder of the wooden mandrel by putting four screws through the disk into the wood. While the disk was revolving at a high motion the soft sheet iron would cut off a ten inch cold-steel file in a few seconds. After we were satisfied that soft iron would cut cold and hard steel (no matter how hard), the disk was put on one of the journals of a circular saw which was driven at a very high motion; and that disk was employed for many years afterward to gum saws of all sizes.

During the past season, having occasion in a new shop to make a goodly number of cutters for the power moulding machine, we made another sheet iron disk, which was fitted to the mandrel of one of the little circular saws, which revolves about two thousand times per minute. After the periphery had been dressed off as true as practicable, that disk of soft iron would (and will) cut off a bar of cold steel four inches broad and one-fourth of an inch thick in one minute, making a kerf as true and smooth as a good saw will cut through a piece of timber. The disk will save an immense amount of filing when making cutters for moulding machines, as we can cut slots into the heel ends of the cutters, and cut and dress off the edge ends faster than twenty men can dress the steel away with chisels and files. One can "gum" an old cross-cut saw, or a mill saw, or drag saw, or large circular saw with such a disk in a few minutes, without any apprehension whatever of cracking or injuring the saw blade. After a large saw has been gummed by an iron disk, if one has a small emery wheel of the proper form he can dress up the teeth almost to a perfect cutting edge without a file, thus saving an enormous expense for files.

I have found in some instances, when gumming cross-cut two-men saws, that the steel of certain kinds of saws would be case-hardened a little on both sides of the kerf made by the disk. That very thin film of case-hardened steel would wear away a new file rapidly. But by employing an emery wheel instead of files until all the case-hardened steel had been removed, the expense for files is always small. Indeed, we use files only to fit up the very points of the teeth.

I may add, for the advantage of beginners, that the true way to fit up the periphery of a disk is to cut it with heavy shears as nearly round as practicable, after which hold a piece of a grindstone or sandstone so that the edge of the disk will strike it when in motion. We always use a stone and file, and then attempt to cut steel a little, thus working off the periphery until it is as smooth and true as it can be made. Then the cold and soft iron when in high motion will literally melt the hard and cold steel and drive the melted metal from the bar in a stream of white-hot sissing and burning steel dust.

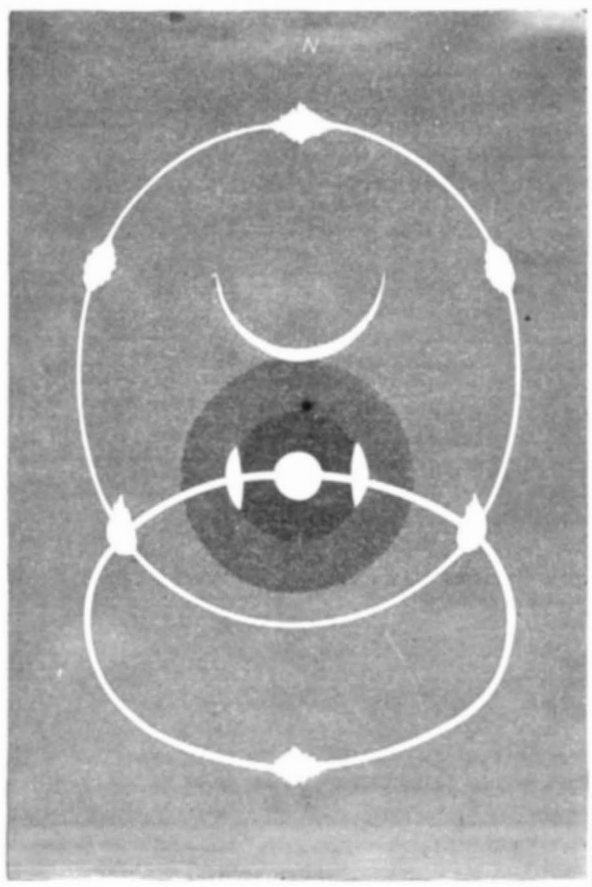
S. E. T.

Orange, N. J.

The Meteor.

To the Editor of the Scientific American:

I send you a diagram of a most singular atmospheric phenomenon witnessed here on the 30th ult. The display in the heavens of so peculiar a combination of reflection and



THE METEOR OF DECEMBER 30, 1880, AS SEEN AT SUNK CENTER, MINN.

refraction of the rays of light was of such rare occurrence I doubt if the like was ever before seen. You may the better understand me if I explain from the diagram. It was first observed at five minutes before eleven o'clock, A.M. The mercury registered at the time 5° below zero. The sky was clear, save that the air was full of floating frost crystals that gave a leaden aspect to the heavens around. The sun, as I have tried to represent, was surrounded by a double halo, both very perfect and distinct in outline. To the right and left of the sun and on the rim of the first halo were very bright parhelia or mock suns. Passing through the sun and these mock suns and around the whole dome of the heavens, seemingly, at about 20° from the horizon, was a great circle of light. This had the appearance of the large ring of Saturn—very bright and about ¼ of a degree in width. Again, about 15° from the rim of the outer or second halo, and in the path of this circle of light, were other parhelia on either side of the sun; and on the opposite side of it, from the sun, was another or third parhelion. This circle was very brilliant, describing a diameter of about 100°. Intersecting this bright circle, at the points of the two parhelia, passed a somewhat less brilliant ring of light in form of an ellipse, with its longest diameter some 130° and the short one 80. At the northern end of the ellipse were three parhelia, as represented in diagram. These mock suns were all very distinct and beautiful. To complete this phenomenon there was as perfect a rainbow as we ever see in midsummer, describing an arc of about 35°, with its crown resting on the rim of the second or outer halo, directly over the sun. In fact this rainbow was of such brilliancy that it was too dazzling for the uncovered eye to look at, unlike the soft mellow tints in our summer rainbow phenomena. The duration of this most rare spectacle was an hour and fifteen minutes.

F. M. MORGAN,
Assistant Principal, Sauk Center High School.
Sauk Center, Minn., December 31, 1880.

New Solvents for Nitrocellulose.

To the Editor of the Scientific American:

In the preparation of nitrocellulose compounds, which are known as celluloid, and are also used as varnishes, some new solvents have been patented in Germany by Parkes. Among others he suggests the use of a solution of tetrachloride of carbon and camphor, either alone or with gums, resins, oils, dyestuffs, etc. He also proposes to use the bichloride of carbon and camphor, when the solution takes place under the aid of heat and pressure. Camphor, too, is a good solvent when heated to its melting point; at this temperature and under pressure it dissolves the nitrocellulose as fast as it can be mixed with the melted camphor until it forms a stiff mass. This mass, to which other substances may be added, can be rolled and pressed into moulds. To lower the melting point he adds oil, paraffine, turpentine, alcohol, benzol, ether, etc., whereby thinner solutions are obtained.

Another powerful solvent for nitrocellulose can be made by conducting sulphurous acid gas through granulated camphor, or by dissolving camphor in sulphurous acid.

A solution of camphor in benzole of such quality that no unpleasant odor is left when the compound is done, works very rapidly with the aid of heat and pressure. Oils, gums, resins, and dyes can be added according to taste. Turpentine and camphor also dissolve it with heat and pressure very quickly. Nitrocellulose softens rapidly if sprinkled with alcohol, ether, or other solvents of gun cotton and then pressed into hot moulds.

Sometimes it is better to dye the nitrocellulose before it is dissolved instead of dyeing the compound, as brilliant and delicate colors are obtained in this way of greater beauty than by the usual manner. If the compounds are to be used as lakes, the above-named solvents can be used, but of course larger quantities of the solvent are required than for making solid bodies. The solvents can be used alone or mixed with gums, resins, pigments, and metallic bronzes, to obtain the greatest variety of waterproof paints for surfaces, as well as cement for capping bottles. The solvents of nitrocellulose above given, as well as the bisulphide of carbon mixed with benzole and alcohol, are likewise good solvents for shellac.

D. I. Z.

[The tetrachloride of carbon is a colorless liquid boiling at 170° Fah.; specific gravity, 1·56. It can be made by the action of chlorine gas upon bisulphide of carbon, or on chloroform; also by the action of pentachloride of antimony upon bisulphide of carbon; sells at $3 per pound.

The bichloride of carbon is a very mobile liquid; specific gravity, 1·62; boiling at 248° Fah. It is generally made from the terchloride. It is quoted at $17 per pound in Berlin; hence we find a strong objection to its use in the arts at present.—ED. SCI. AM.]

Easy Test for the Purity of Olive Oil.

When it is desired only to ascertain whether the oil is pure or not without precise reference to the nature of the oils used in adulteration, take equal quantities of olive oil known to be pure and the oil to be tested, place the samples in separate test tubes, into which a good thermometer may also be inserted, and heat each separately to a temperature of 482° Fah. The pure oil will become somewhat paler during the heating, while the adulterated oil will turn darker. The pure oil will emit a pleasant smell, while the adulterant oils will give off an offensive odor.

To Prevent Clouding of Mirrors by Moisture.

A writer in the *Manufacturer and Builder* says that by coating over the surface of glass mirrors with glycerine their clouding by the accumulation of condensed water vapor will be prevented for a considerable time. The attraction of the glycerine is so great for the water as to absorb the latter as fast as deposited. This hint may prove of great use to dentists, who are frequently troubled by the clouding of mouth-mirrors, and it may also be of value to those who are compelled to shave themselves in chilly apartments.

SALT WATER FOR STREET USES.—The town of Tynemouth, England, has lately completed arrangements for supplying salt water from the mains of all the principal thoroughfares of the place. Salt water is to be used for flushing the sewers, watering the streets, and supplying public baths.

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DYNAMO-TELEGRAPHY.

Until within a comparatively recent period all attempts at transmission of telegraphic messages with dynamo-electricity have proven futile.

There seemed to be no probability that the old voltaic battery system, involving multitudinous inconveniences, would ever be supplanted, and there are at the present time only two systems of dynamical telegraphs which are operative from a successful standpoint, both being of very recent origin and as yet comparatively unknown to the public.

For the successful operation of any telegraph line two important elements enter into consideration, viz.:

1st. A steady or uniform current.

2d. Delicate adjustment of receiving instruments; and any variation of the former necessarily precludes the possibility of the latter, so that they may be operative under all conditions of the line.

It is scarcely necessary to add that electricians have never fully appreciated the difficulties to be overcome in this class of telegraphy, and their attempts heretofore but verify this assertion.

These fluctuations of current are due to several causes, viz.:

1st. Any change of velocity in the generator.

2d. Any variation of external or internal resistance (the latter being often the result of the former, owing to high normal internal resistance); and either necessarily varying the electromotive force, and hence the current to line.

3d. To a total discharge of the magnetism in the field of force magnets on opening the line, and thus completely breaking down the currents until the line shall again be closed.

This might properly be included under the same head as the second, inasmuch as a total discharge of the field of force magnets is, theoretically speaking, simply the result of an infinite resistance offered to the current.

A dynamo machine produces a current of electricity by a series of actions and reactions in its internal mechanism; that is to say, the armature of the machine acts upon the field of force magnets, and these in turn react upon the armature at each revolution, and thus a set of actions and reactions ensue until a max mum effect is attained. This results when the neutral fluids (so to speak) balance each other.

Now, any increase in the external or line resistance acts to discharge the field of force magnets, and a break in the line, which necessarily occurs on opening a key to transmit a signal, increases the resistance to an infinite amount, and hence totally discharges the field of force magnets. Hence, inasmuch as it requires a definite time to charge the line by the above described series of actions and reactions, it is obvious that there would ensue at each break such fluctuations of current as would totally prevent any transmission of signals.

Furthermore, such an increase of external resistance reacts upon the machine and heats it internally, thus offering another objectionable element.

Thus we have a series of changes, which, acting under varying circumstances, produce fluctuations in the line current beyond the limits of accurate adjustment of delicate receiving instruments required on long lines of high resistance.

The problem, then, to be solved is:

1st. To prevent the total discharge of the field of force magnets on any variation of external resistance; or, at least, to provide some means for a constant relation between the resistances and the electromotive force of the machine.

2d. To prevent undue variations of current caused by an increase or decrease of the velocity of the generator.

Two systems have been devised which involve all of the essential principles required by the problem: one the invention of Mr. Stephen D. Field, Jr., and the other of Dr. Orazio Lugo, of New York city.

To obviate the first difficulty, Mr. Field energizes his field of force magnets by an independent generator, actuated by an independent power, the circuit from the commutators being through the field of force magnets of said generator, thence through the coils of the field of force magnets which develop the line currents. This circuit is entirely independent from the line circuit, and constitutes, as it were, an infinite supply of electricity to energize the field of force magnets, or at any rate an inexhaustible supply dependent on the power and capacity of the generator.

Hence, any change of resistance in the line can have no appreciable effect upon the field of force magnets.

To obviate any change in the current due to a change of velocity of the generator, he connects up a series of line generators whose field of force magnets are energized as above, and connects the commutators and said line generators to common supply points, being necessarily at the opposite poles of the machine. Each generator of line currents is actuated by an independent pulley, so that any change of velocity of any one generator can only affect the sum total of currents by its proportional ratio of gain or loss.

Theoretically, then, an infinite number of generators would be required to produce the best results, bearing in mind, of course, that such a series implies a range of velocities or changes of relative velocities varying from zero to infinity.

It is found in practice that a series of five generators produces satisfactory results. This, of course, is apparent if we consider that a change of velocity in any one from a normal velocity is not liable under ordinary circumstances to be more than ten per cent.

It is apparent that any change of velocity in the generator which energizes the field of force magnets would increase proportionately the electromotive force of the line generators. This is obviated by a governor which regulates the speed of the motive force and keeps it within practical limitations.

The same system of generators might be used to energize the field of force magnets as is required to generate line currents, thus making the system automatic in its operation; but this feature does not appear to have suggested itself to Mr. Field. In this manner any change of speed in any one of the energizing machines would only affect the line field of force magnets a proportional amount, as above suggested.

Thus it will be seen that if any one of the five generators increases or decreases twenty per cent from the normal rate it only has a proportionate effect of one twenty-fifth of the whole line current, which in practice is found to be inappreciable.

The broad idea of energizing the field of force magnets by an independent generator is not new *per se*, as is seen in the Wilde machine; but Mr. Field claims to be the first to energize a series of field of force magnets in this way, and just how much invention is involved in this idea it is not the province of this article to discuss.

Dr. Lugo has recently invented and patented a much simpler method of avoiding these difficulties, dependent upon well known electrical laws.

He uses a single current generator on the line with a shunt wire of low resistance, connecting the opposite poles thereof; so that the total resistance is that due to the lines, the shunt, and the machine.

The resistance of the shunt is less than that of the external lines and greater than that of the machine itself.

There results from this combination, under well known laws, a proportionate division of current between the line and the shunt; a much larger portion, of course, going through the shunt because of its low resistance.

It is obvious, then, that the field of force magnets can never be discharged, for there is always a path of low resistance for the current. Hence the electromotive force is dependent only upon two causes for its variations, viz., a change of velocity of the generator and a change of resistances between the shunt and the line. The former it is proposed to regulate by electrical governors, such as are well known, dependent upon the current sent to line, and the latter is in a measure automatically regulated by the shunt itself, inasmuch as changes of fluctuations which result from changes of resistances in the external line necessarily increase the flow in the shunt itself, and hence vary the resistance of the shunt by heating it. Hence there can be no change of resistance in the internal machine, because normally it is much less than that of the shunt. Of course in practice these adjustments must be made dependent upon varying circumstances of the external lines, but certain ratios may be attained which will produce the best results, and theoretically this will be when these line resistances equal that of the shunt.

When they pass below this limit the system is, of course, inoperative; but there exists a sufficient limit under ordinary circumstances to afford a perfect working system. This limit, it will be understood, is dependent upon the relative sectional area of the external line and that of the shunt, which affords sufficient resistance to prevent the machine from heating; thus in practice the generator never grows warm.

An attendant at the shunt may regulate variable resistances by testing the warmth thereof. Hence as long as a mean temperature exists a uniform current flows to line and no change need be made.

Both of the above described systems are in use, and the best results are attained; it being found that steady currents at all times flow on the line.

It is then entirely probable that within the next decade we shall find our large telegraphic corporations operating their elevators, supplying motive power, heat, and light throughout their buildings, and electricity for their lines from one common source of power.

Thus saving annually thousands of dollars, and being happily rid of numerous annoyances consequent upon such a system of forces as now exists by a concentration thereof at one common center.

C. J. KINTNER,
U. S. Patent Office.

Improvements in Cotton Pressing.

The new Morse Compresses in New Orleans are producing astonishing results by way of largely increased cargoes of cotton from this port.

The ship Mary E. Riggs, of 1,277 tons American register (1,226 British), received a cargo of 5,400 bales of cotton, weighing 2,568,640 pounds; making 2,011 pounds per ton American and 2,095 pounds per ton British measurement.

The first cargo of this ship from this port was 3,740 bales; the last, and largest (previous to the present one), was 4,364 bales, weighing 1,943,498 pounds. Her present cargo of 5,400 bales exceeds her largest previous cargo 1,036 bales, or 625,142 pounds, exceeding her largest previous cargo 1,404 bales of same average weight. With freight at one cent per pound and five per cent primage, the value of this increase, for this medium-sized vessel, is about $6,600. This cargo was compressed, without the advantage of a "tie puller," in the ordinary course of business by the Factors' Press, one of the seven large Morse Compresses. The only cargoes of single bales taken by sail vessels approximating this one are the following:

The Minnie H. Gerow (1,304 tons American), from the Champion Press, 2,481,790 = 1,903 pounds per ton measurement. The Western Empire (1,399 tons American register), from the Champion Press, 2,022 per ton. The Minnie H. Gerow, from the International Press (Taylor hydraulic, 64-inch cylinders), 2,644,906 = 2,028 pounds per ton. But in all of these cargoes of 1,903, 2,022, and 2,028 per ton measurement, tie pullers were used for which is claimed an advantage of 20 per cent. If the present cargo of the Mary E. Riggs had had this advantage, her 2,011 pounds per ton American, and 2,095 British, would have been 2,413 and 2,514 per ton—or say 20 per cent larger than any cargo of single bales ever cleared in this country.

Since the above, the British ship Ben Lomond, of 887 tons register, cleared at New Orleans by her agents, Messrs. Forstall, Ross & Clayton, with 4,363 bales cotton under deck, none in cabin or crew spaces, weighing 2,054,848 pounds, making 2,316 pounds to the ton measurement. This is the largest cargo per ton ever taken by a sail vessel from an American port. The larger part of this cargo was "doubled." The cotton was tied by hand (by colored men), and consequently without the 20 per cent advantage claimed for steam "band pullers." It was all compressed at the Southern Press by the 90-inch cylinder Morse Compress. Not more than three years ago the average cargoes of ships from this port did not exceed 1,425 pounds per ton register; and for other modern-built presses the average is now about 1,725. The above cargo of 2,316, without tie pullers, therefore, exceeds recent average compressing by 35 per cent, or 524,773 pounds, in a single cargo of a small ship like the Ben Lomond, and at the rate of freight received makes a gain of £820—say, $3,936. The proprietors claim that under more favorable circumstances the 90-inch Morse Compress can considerably excel the above.

The Keely Motor Deception.

It is stated that immediately after the annual meeting of the Keely motor stockholders, held two weeks ago, a couple of gentlemen who are heavy on the motor stock called upon Mr. Keely and demanded that he should at once name a day and date for a public exhibition of his wonderful apparatus. They had a very plain talk with him, and announced that they voiced the sentiments of most of the parties interested. Unless the engine was put to work within a short time and sawed wood, sent a locomotive to Jericho on a pint of water, and did a hundred other things claimed for it, they would resist further payments to the discoverer.

Keely was not the least disturbed by their threats, and when they found this they began to persuade and coax him, as a boom in the stock was needed. The man of mysteries declined to accede to their requests, but said: "I see my way as clear as sunlight." Then he eased their minds by stating that he would make no further demands upon the company for funds for his own use, because he had enough to live on. This was very assuring, and made the stockholders happy. If they did not give him the money to complete his invention, he told them that he would keep his secrets to himself. This caused some bitter words, and Mr. Keely was the recipient of some unvarnished opinions. Already they had spent over $500,000 on the machine, and could see no appreciable results. Keely plainly informed his visitors that he would not give an exhibition for two months at least, because the engine needed some alterations.

Keely has had a new engine built at a cost of $10,000, and the lower one has been placed on the lower floor of the building on Twentieth street. Keely promised that when the exhibition is given both engines should be placed in operation, so as to show the improvement in the new one over the old. The callers were compelled to depart without being able to convince Keely that a time for a boom was near at hand.

The stock of the Keely Motor Company is now held at about $7 per share. This time last year it was worth $18. The highest it ever reached was $300, when 3,000 shares were disposed of in New York at the figures named. The average price has been about $150 per share, and the transactions at those rates have been large. Of the present stockholders but few were on the original list, they having all been able to get out at the top price. Keely has been at work some seven years.—*Philadelphia Record.*

Paraffine as a Wood Preserver.

A German chemist, Dr. Schal, has established the useful fact that wood impregnated with paraffine is preserved from rot, especially when employed in alizarine manufactures, where it is exposed to the decaying action of damp, acid, and alkaline lyes. Wooden vessels which become totally rotten in two months last for two years when impregnated with paraffine. The preparation of the wood is effected by drying it in warm air for three weeks, then steeped in melted paraffine to which has been added some petroleum ether or sulphuret of carbon. In preparing this bath great care must, however, be exercised, owing to the inflammability of its ingredients. To prevent the paraffine from escaping from the pores, the wood should be coated with oil varnish or soluble glass, washed after drying with diluted hydrochloric acid. The silicic acid thus formed clogs up the pores from the outside, and protects the paraffine from the action of water. Paraffine, melted with equal parts of linseed or rapeseed oil, is also, according to Dr. Schal, useful for coating iron vessels, which in chemical manufactories are otherwise very liable to rust.

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IMPROVED HAND PRESS.

The engraving shows a domestic hand press for fruit, cracklings, hominy, and other articles which require separation from the liquid which they may contain. The invention consists of a perforated bowl or receptacle having a rigid handle extending at right angles to the plane of the bowl, and a perforated presser head conforming to the bowl and connected by a slide with the handle of the bowl. The sliding presser head is connected by a link with a lever handle pivoted to the main handle. By bringing the presser head down on the material contained in the bowl by means of the lever, the liquid is expelled through the perforations. This invention was lately patented by Mr. J. T. Haile, of Whitesborough, Texas.

HAILE'S HAND PRESS.

GOLD IN NEW YORK STATE. — Two hundred and eighty-three notices of discovery of gold and silver were officially entered at Albany, last year. The alleged deposits are chiefly in Hamilton County. The law prescribes that mines of gold or silver found in New York shall be property of the State, but gives to the discoverers or their assigns the right to work them for twenty-one years free of any royalty on condition that they file with the Secretary of State notices describing their discoveries. After the twenty-one years the Legislature may dispose of the mines at its discretion; but the discoverers or their representatives shall be preferred in contracts for working them.

IMPROVED OIL-STOVE WICK TRIMMER.

In ordinary oil-burning stoves it is necessary to remove the top of the stove, and any utensils which may be in use in order to trim off the crust which forms on the wicks and prevents the free operation of the stove. It is necessary to put out the fire before the wick can be trimmed. Beside the great inconvenience and delay in trimming the wick with shears in the common way, the wicks are wasted, and with the sharpest shears they will be poorly trimmed on account of their great width, and an uneven burning surface will be left which causes the stove to smoke and throw off a bad odor. Kerosene stoves are often condemned for this reason alone.

By means of the simple invention shown in the engraving these inconveniences are avoided, and the wick is quickly and evenly trimmed. This device is in every way superior to the old method.

A wick should never be cut; it is only necessary to remove the crust, and the stove or lamp burns freely with a flame of the proper form.

This invention is simple in its application and is thoroughly practicable. It consists of a wire rod carrying one or more lateral arms extending over the wick tubes. This wire passes through the front of the stove, and is provided with a ring or handle by which it may be grasped and moved back and forth over the ends of the wicks while they are turned down. By this means the crust is removed and a clean and free burning wick is left, without extinguishing the flame or removing any part of the stove or furniture.

Each wick tube is provided with a guide which is bent up at the ends forming a stop for the trimming attachment. Oil stove manufacturers may, with advantage, adopt this simple but useful and effective invention.

This invention has been patented by Messrs. Walker and Williams, and is owned by Walker, Williams & Co., Sing Sing, N. Y.

A Use for Cotton Seed Hulls.

The Chicago *Railway Review* reports that the use of cotton seed hulls as a substitute for cotton waste in packing the journal boxes of cars and locomotives has been adopted on several roads, and others are preparing to adopt it. It is claimed that the hulls are actually superior to ordinary cotton waste for packing, and would be preferable at the same cost. But the cheapest cotton waste is worth 7½ cents a pound, and the superior grades range as high as 14 cents. Cotton seed hulls can be delivered in any part of the United States at one cent a pound.

Cements for the Shop.

Iron Cement for Closing the Joints of Iron Pipes.—Take of coarsely powdered iron borings, 5 pounds; powdered sal-ammoniac, 2 ounces; sulphur, 1 ounce; and water sufficient to moisten it. This composition hardens rapidly; but if time can be allowed, it sets more firmly without the sulphur. It must be used as soon as mixed, and rammed tightly into the joint.

2. Take sal-ammoniac, 2 ounces; sublimated sulphur, 1 ounce; cast iron filings or turnings, 1 pound; mix in a mortar and keep the powder dry. When it is to be used, mix it with 20 times its weight of clean iron turnings or filings, and grind the whole in a mortar; then wet it with water until it becomes of convenient consistency, when it is to be applied to the joint. After a time it becomes as hard and strong as any part of the metal.

Cement for Uniting Leather and Metal.—Wash the metal with hot gelatine; steep the leather in an infusion of nut-galls (hot) and bring the two together.

Cement for Leather Belting.—One who has tried everything, says that after an experience of fifteen years he has found nothing to equal the following: Common glue and isinglass, equal parts, soaked for ten hours in just enough water to cover them. Bring gradually to a boiling heat, and add pure tannin until the whole becomes ropy, or appears like the white of an egg. Buff off the surfaces to be jointed, apply this cement warm, and clamp firmly.

Steam Boiler Cement.—Mix two parts of finely powdered litharge with one part of very fine sand, and one part of quicklime which has been allowed to slake spontaneously by exposure to the air. This mixture may be kept for any length of time without injuring. In using it, a portion is mixed into paste with linseed oil; or, still better, in boiled linseed oil. In this state it must be quickly applied, as it soon becomes hard.

Turner Cement.—Melt one pound of rosin in a pan over the fire, and when melted, add one-quarter of a pound of pitch. While these are boiling, add brickdust until by dropping a little on a cold stone, you think it hard enough. In winter it may be necessary to add a little tallow. By means of this cement a piece of wood may be fastened to the chuck, which will hold when cool; and when the work is finished, it may be removed by a smart stroke with the tool. Any traces of the cement may be removed from the work by means of benzine.

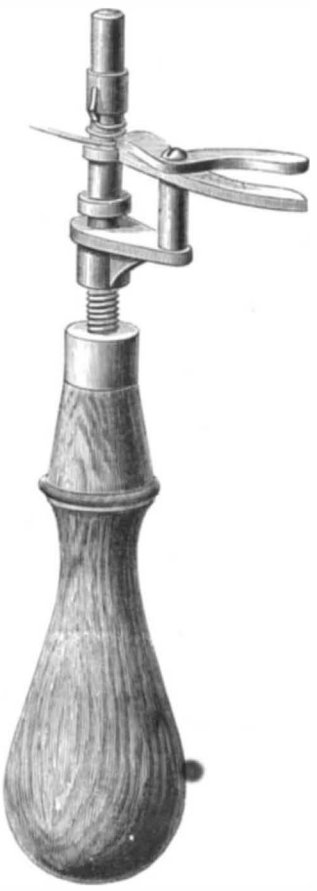
Wollaston's White Cement for Large Objects.—Beeswax, 1 ounce; rosin, 4 ounces; powdered plaster of Paris, 5 ounces. Melt together. To use, warm the edges of the specimen, and apply the cement warm.

Gutta Percha Cement.—This highly recommended cement is made by melting together, in an iron pan, two parts of common pitch and one of gutta-percha, stirring them well together until thoroughly incorporated, and then pouring the liquid into cold water. When cold it is black, solid, and elastic; but it softens with heat, and at 100° Fah. is a thin fluid. It may be used as a soft paste, or in a liquid state, and answers an excellent purpose in cementing metal, glass, porcelain, ivory, etc. It may be used instead of putty in glazing windows.

THE miner's inch is the amount of water flowing in one second from an orifice 1 inch x 1 inch, under a head of 6 inches, measured from the upper side of the orifice.

SPRING-MAKING TOOL.

A hand tool to be used principally by jewelers for making wire spirals for shirt studs and buttons is shown in the annexed engraving. The mandrel upon which the spirals are formed is secured to an ordinary tool handle, and a carrier is fitted to the lower portion of the mandrel, which is threaded, the pitch corresponding with that of the spiral to be made. The end of the wire is placed in a slot in the end of the mandrel, and while the handle is turned with one hand, the carrier is held in the other hand, and the wire is pressed down upon the mandrel by a small lever pivoted to the carrier and grasped between the thumb and finger.



TOOL FOR MAKING SPIRAL SPRINGS.

The crook at the end of the coil is formed by bending the wire back upon the end of the lever.

This invention was recently patented by Mr. A. R. Wilbur, of Baltimore, Md.

NEW INVENTIONS.

An improvement in that class of devices that are designed for releasing a horse instantly from the vehicle to which he may be attached, has been patented by Mr. Whitefoord S. Martin, of Maybinton, S. C. An iron rod is attached to each end of the whiffletree and extends forward a short distance alongside the shafts or thills. The short leather traces are attached to the front ends of these rods by means of keys or eyebolts, which may be withdrawn—for the purpose of releasing the horse from the vehicle—by means of cords or straps that pass through a ring on the crupper or back-strap of the harness, and extend back over the dasher of the vehicle, so as to be easily accessible to the driver.

Mr. John W. Donnel, of Bedford, Iowa, has patented a self-adjusting driver for millstones, by which the stone is balanced on the top of the cock head, and thereby adjusted with a minimum of friction. The invention consists in the combination of a yoke pivoted to the upper end of a mill spindle so as to swing in a vertical plane, and four levers arranged in pairs, one pair being pivoted to each side of the yoke and suspending another yoke, which serves to make all the levers move together. The levers pivoted to the pivotal yoke extend above the point of the mill spindle and are provided with set screws, which bear against the bail at points lying in the same plane and in line with the point of the spindle.

A snow scraper, patented by Geo. F. Bond, of Troy, N. Y., is an improvement in apparatus for clearing ice fields for ice harvesting. Side boards or runners are pivoted or hinged at the front end and provided with apparatus whereby they may be made to assume the V-form, or closed into a parallel position for discharging their load at the will of the operator.

A sugar washing process and apparatus, patented by John V. V. Booraem, of Brooklyn, N. Y., acts to thoroughly wet and wash the crystals of sugar with water or sirup, and deliver the mass in a perfectly homogeneous state to the centrifugal machines. For this end a perforated pipe delivers water in a finely divided state upon the sugar just prior to the passage of the latter through crushing rollers, the pipe and rollers being arranged in relation with each other to secure the object sought. After crushing the sugar is further worked by revolving screws.

An improvement in tile and brick kilns, patented by Mr. Eber Davenport, of Waynesville, Ill., saves time, labor, and fuel. The kiln is circular, has furnaces and fire walls arranged around its peripheral wall, and a central opening in the top. The circulation of the heated air and gases is first upward near the outside wall, then downward, then upward again and out at the central opening, the deflection of the heated currents being effected by the fire walls, crown wall, and vertical passages with bottom flues formed in laying the bricks or tiles when filling the kiln.

A patent on a folding car step, granted to Mr. Josiah W. Radbraugh, of Columbus, Ohio, covers a combination of the folding steps of a car with mechanism whereby the steps on both sides of a car may be simultaneously adjusted by a single movement of a lever.

Fig. 1.

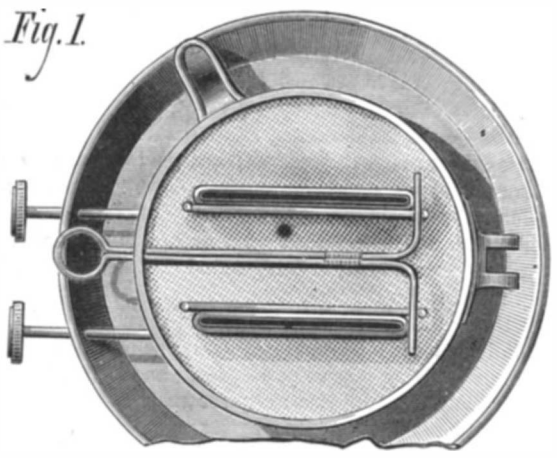
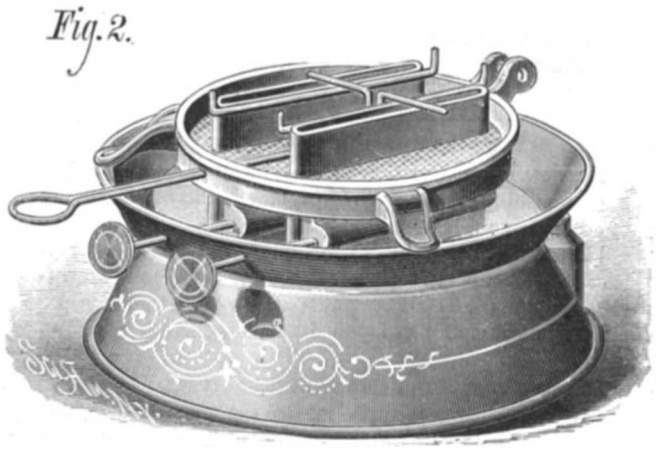


Fig. 2.



IMPROVED OIL-STOVE WICK TRIMMER.

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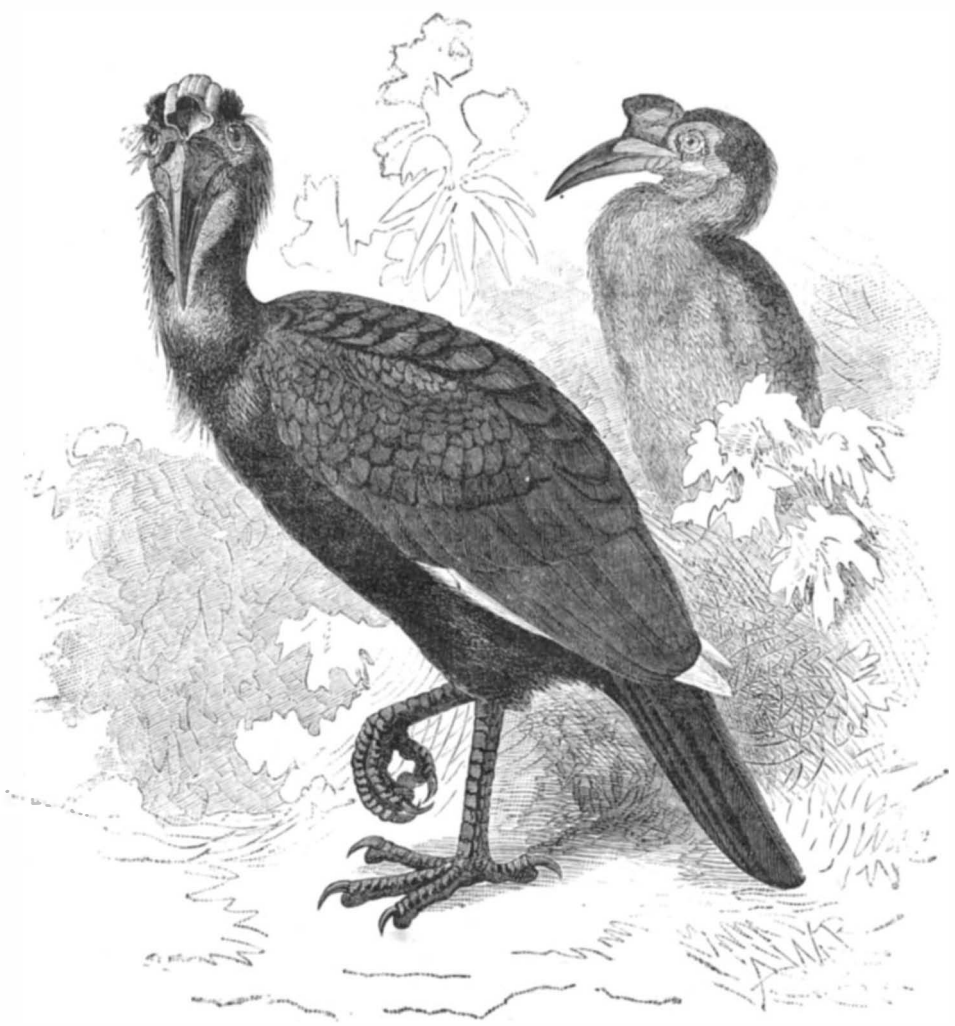
THE COMMON HORNBILL.

The common hornbill (*Tmetoceros abyssinicus*) is a strong, short-winged bird with a short tail and comparatively long legs. The beak is very large, curved slightly, flattened on the sides, and is provided with a short but quite high protuberance at the root. This protuberance begins on the center line of the beak, projects forward to about one-third of the length of the beak, and may be open or closed in part, and has the general appearance of a helmet. The legs are much more powerful than those of other hornbills and have very strong claws. The sixth feather of the wing is the longest, and the point of the wing projects only a short distance beyond the upper arm feathers. The color of the bird is absolutely black, excepting ten yellowish white feathers of the wings. The eye is dark-brown, the iris lead blue and red, and the beak is black excepting a spot on the upper beak, which is yellow in front and red in the rear. The length of the bird is about four feet. It is found in Central and Southern Africa.



THE COMMON HORNBILL.

The White Ant's Parasites.

At a late meeting of the Philadelphia Academy of Natural Sciences, Dr. R. S. Kenderdine exhibited specimens of the wonderful parasites found recently by Dr. Leidy in the intestines of the white ant, where they occur in such myriads as to constitute a mass greater in bulk than the food of the insect. When the intestine is ruptured millions of these living occupants escape, reminding one of the pouring out of a multitude of persons from a crowded meeting-house. So numerous are these parasites, and so varied their form, movement, and activity, that their distinctive characters cannot be seen until they become more or less widely diffused and separated.

The termites or white ants are so common, easily obtained and preserved alive, and their parasites are so exceedingly numerous and constant in their occurrence, that once the fact becomes sufficiently known the insects will be favorite subjects to illustrate at once the infinity of life and the wonders that are revealed by the microscope. The forms observed, together with a species of microscopic plant found in the same situation, are fully described and beautifully illustrated by Dr. Leidy in the forthcoming number of the Journal of the Academy.

HUMAN TREES OF INDIA.

BY DANIEL C. BEARD.

All those who feel a sufficient interest in the subject to study or notice the facts must at times be struck with amazement at the wonderful resemblance of certain insects and other animals to vegetable and inanimate objects. So exact is this resemblance in some instances as to deceive the most experienced. Wallace, the great naturalist, was very anxious to secure a specimen of a certain brilliant butterfly, but was unable for some time to capture one on account of the creature's sudden unaccountable and mysterious disappearance. He finally discovered that the outside of this insect's wings was an exact representation of a leaf. When the butterfly alighted upon a shrub and closed its wings it completely deceived even this experienced scientist. Some species of lobsters found at Bermuda so closely resemble submarine stones, even to the coating of sea weeds, that I have passed by an aquarium containing them supposing the tank to be uninhabited. The common katydid, whose constantly-repeated notes, late in summer, warn us of the approaching frosts, has a representative in South America, whose wings not only resemble a green leaf, but, to add to the deception, the tips of the wings are ragged and discolored, having the exact appearance of a leaf that has been disfigured from the attacks of caterpillars. I once had one in my studio, and it was with great difficulty that I could convince visitors that it was not an artificial insect with wings made of real leaves. In the snow-covered regions of the North the foxes, hares, bears, and birds, with very few exceptions, assume the prevailing white color of the surrounding objects. Man has not been blind to these hints. There are various tribes of savages who successfully imitate stumps and stones by remaining immovable in crouching positions so as to baffle their pursuers.

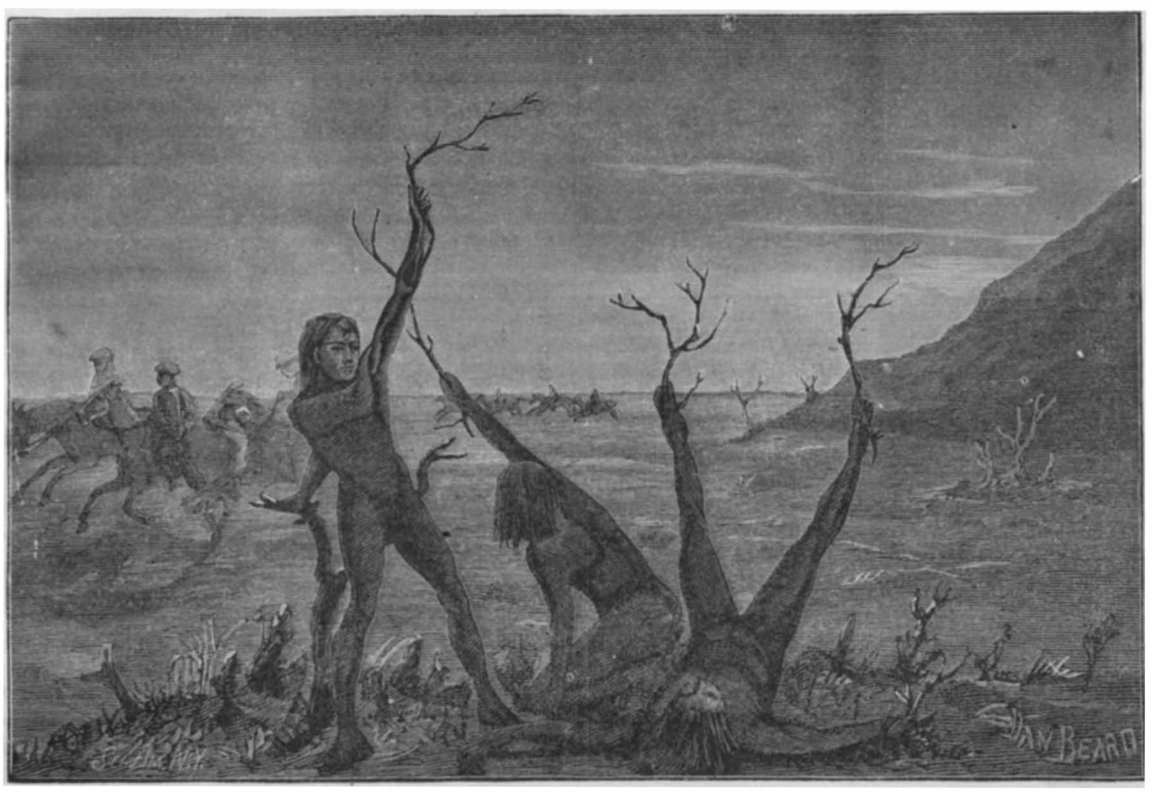
This mimicry is carried to a wonderful degree of perfection in India. That strange country, as Dr. Latham says, "of a teeming, ingenious, and industrious but rarely independent population. It is a country of an ancient literature and ancient architecture," and, he might have added, of a modern degradation. A country where such a society as the murderous thugs is possible; a country where robbers are educated from childhood for the profession in which they take great pride, openly boasting of their skill. One of our most skillful and adroit bank robbers would be considered by these India experts but a bungling amateur.

The scientific manner in which these robbers prepare for their raids shows a thorough knowledge of the dangers of their calling, and the best guards against the same, choosing darkness for their forays. When their dusky bodies are least observable they remove their clothes, anoint themselves with oil, and with a single weapon, a keen-edged knife suspended from their neck, creep and steal like shadows noiselessly through the darkness. If detected, their greasy and slippery bodies assist them in eluding capture, while their razor-bladed knife dexterously severs the wrist of any detaining hand. But the most ingenious device to escape capture is that shown by the Bheel robbers in the accompanying illustration. It often happens that a band of these robbers are pursued by mounted Englishmen, and unable to reach the jungle, find themselves about to be overtaken upon one of those open plains which have been cleared by fire, the only shelter in sight being the blackened trunks or leafless branches of small trees that perished in the flames. For men so skilled in posturing this is shelter enough. Quickly divesting themselves of their scanty clothing, they scatter it with their plunder in small piles over the plain, covering them with their round shields so that they have the appearance of lumps of earth and attract no attention. This accomplished, they snatch up a few sticks, throw their body into a contorted position, and stand or crouch immovable until their unsuspicious enemies have galloped by.

When all is safe they quickly pick up their spoil and proceed upon their way.

The Rev. J. D. Woods gives an interesting account of these marvelous mimics. I quote the following:

"Before the English had become used to these maneuvers, a very ludicrous incident occurred. An officer, with a party of horse, was chasing a small body of Bheel robbers, and was fast overtaking them. Suddenly the robbers ran behind a rock or some such obstacle, which hid them for a moment, and when the soldiers came up the men had mysteriously disappeared. After an unavailing search, the officer ordered his men to dismount beside a clump of scorched and withered trees; and the day being very hot, he took off his helmet and hung it on a branch by which he was standing. The branch in question turned out to be the leg of a Bheel, who burst into a scream of laughter, and flung the astonished officer to the ground. The clump of scorched trees suddenly became metamorphosed into men, and the whole party dispersed in different directions before the Englishmen could recover from their surprise, carrying with them the officer's helmet by way of trophy."



HUMAN TREES OF INDIA.—BHEEL ROBBERS IN HIDING.

Marine Fauna of the New England Coast.

To the current number of the *American Journal of Science and Arts*, Prof. A. E. Verrill contributes an article on the remarkable marine fauna discovered during the present season off the southern coast of New England by the naturalists connected with the U. S. Fish Commission. The stations at which dredgings were made are all located in the regions designated on the charts as "Block Island Soundings," and nearly all proved to be exceedingly rich in animal life, the vast abundance of individuals of many of the species taken being almost as surprising as the great number and variety of the species themselves. Crustacea, mollusks, annelids, and echinoderms were most numerous. The very large number of specimens obtained on the three trips has, as yet, been only partially examined, but enough has already been done to prove this region to be altogether the richest and most remarkable dredging ground ever discovered on our coast. Of mollusks, about 175 species were taken, 120 of which were not before known to occur on the southern coast of New England; about 65 are additions to the American fauna, and of these about 30 are apparently undescribed species. The star-fishes and ophiurians were exceedingly abundant and beautiful at all the stations, and many species not previously known to our coast were taken, several of these appearing to be undescribed, while others were known only from Northern Europe or from the deep waters off Florida. Many of the species have only recently been obtained from the northern fishing banks off Nova Scotia. One new species of *Archaster* was particularly abundant, several thousands of specimens having been taken. But the two largest and most beautiful species of this genus were *Archaster Agassizii* (new),

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and *A. Florœ*. Of *Odontaster hispidus* over 100 were taken. One of the most conspicuous star fishes was the remarkable *Pteraster multipes*, Sars, one specimen of which was over six inches in diameter, and very thick and heavy. Its color when living is rich purple above, with the lower side orange streaked with brown, and with large dark purple suckers. A large and handsome orange-colored species of *Luidia* (apparently *L. elegans*), often ten to fifteen inches broad, was very common, but nearly all the specimens dismembered themselves before they reached the surface. Large specimens of two Floridian sea urchins were also taken.

What Machinery has done for Agriculture.

The various agricultural shows held last autumn in different parts of the country cannot fail to impress all who visited them with the extraordinary developments made in recent years in mechanical appliances for agriculture. It is well, therefore, to notice the benefits which this industry has derived from the genius and the labors of the mechanician. We may go back in thought to the time when the spade, the hoe, the sickle, and the flail comprised the farmer's store of machinery, and when the plow was the rudest contrivance hardly worthy to be called a tool. Then every man tilled the soil or engaged in pastoral pursuits because it was all one man could do to provide himself and his dependents with food. Then each man was forced to clothe himself and be his own mechanic for this simple reason. He labored long and with infinite pains, and the ancient sentence that man should earn his bread by the sweat of his brow came home to him with unmitigated force. In course of time improved and effective tools so lightened the labors of the agriculturist, and so increased his products, that the opportunity to make a division of labor arrived, because there was food to spare for the mechanic. This condition of things became more and more firmly established, until it changed the whole social and political aspect of human affairs. And now what do we see? The true "landlord" is not the owner of an English estate, proclaims a writer in *Capital and Labor*, but the farmer who commands an army of farmers, with brigades of plows, reapers, and other machinery upon the plains of Western America. He makes laws for countries thousands of miles away, and his products rule the world's markets. The genius of agriculture to-day is the mechanic; the soul of agriculture is the inventor. One farmer can now, with the help of machinery, feed a hundred men with greater ease than at one time he could feed himself alone. The farmer supports the railroads, for stocks rise and fall with the good and indifferent reports of what the harvest shall be. He supports lines of steamers with his wonderful freights of breadstuffs, provisions, meats, cattle, and sheep. He maintains the millions of artisans who clothe and shelter him, and who provide for every one of his wants outside of the field.

The mechanical power of the age is like a series of concentric and eccentric circles, of which the farmer stands out in the principal center. These all revolve with and about agriculture, and the same force sets all in motion. It is the farmer's duty now to make the most of his opportunities. He should be the foremost man of the age. His influence should be felt everywhere. It is felt everywhere, for the wealthiest merchants and capitalists and the most active politicians all ask themselves how far the farmers can be depended upon before they make a movement in their special pursuits. But the farmer should feel this himself. It is one thing to have power, and another thing to be cognizant of the possession. Let the farmers consider now their position, and, as they take a view of it, let them consider what they owe to the power and influence of machinery. One most conspicuous example of the results pointed out may be noted. A few years ago Minnesota spring wheat was graded very low in the grain markets and brought a low price. Unfortunately for the Western farmers this grade of spring wheat was the only one they could produce. A new process in milling was introduced. Elaborate machinery was invented to perfect the process. The best wheat by this process was the grade known as "Minnesota spring," theretofore despised and rejected—literally "rejected," in fact, in the markets. Afterward this grade became sought by millers, and the value advanced to a point equal to, and sometimes more than that of the previously much-sought winter wheats. If Minnesota farmers produce forty million bushels of wheat annually, this advanced value, due to the new process, puts several millions of dollars yearly into their pockets; and what a vast amount of comfort and happiness may be secured by the right use of so much money! This is but one instance of the vast concatenation of circumstances which points the moral here alluded to.

Supposed Preventive for Carpet Beetles.

A writer in the Germantown *Telegraph* suggests that, as the larvæ of the bacon beetle (*Dermestes lardarius*), an insect closely allied to the carpet beetle, will shun their food when tallow is placed near them, their repugnance to that substance being so great that the insects will devour each other rather than approach it, the same peculiarity may be quite possibly met with in the larvæ of the carpet beetle; and if so the coating of floors and filling the cracks with tallow (the cracks being their place of concealment) would possibly prove an effective destroyer of these troublesome pests. The experiment could be easily tried. If good mutton tallow be employed there could be no hurtful absorption of the grease, especially when the carpets have linen backs.

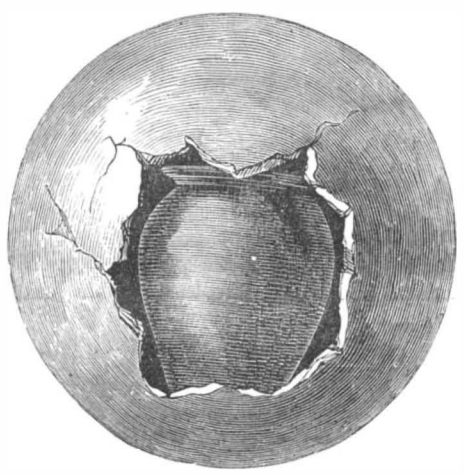
The Year.

The Egyptians, it is said, were the first who fixed the length of the year. The Roman year was introduced by Romulus, 738 B.C., and it was corrected by Numa, 713 B.C., and again by Julius Cæsar, 45 B.C., who fixed the solar year as being 365 days and 6 hours. This was denominated the Julian Style, and prevailed generally throughout the Christian world till the time of Pope Gregory XIII. The calendar of Julius Cæsar was defective in this particular, that the solar year consisted of 365 days 5 hours and 49 minutes, and not of 365 days 6 hours. This difference at the time of Gregory XIII. had amounted to 10 entire days. To obviate this error Gregory ordained in 1582 that *that* year should consist of 365 days only; and in 1751 it was ordered to be so used in England; and the next year 11 days were left out, the 3d of September, 1752, being reckoned as the 14th, so as to make it agree with the Gregory Calendar. The Russians still adhere to the Julian Calendar (called now *Old Style*), which is 12 days behind the reckoning of the Gregorian.

The year 1881 will be a mathematical curiosity. From right to left and left to right it reads the same. Eighteen divided by 2 gives 9 as a quotient; 81 divided by 9 gives 9; if divided by 9 the quotient contains a 9; if multiplied by 9 the product contains two 9s; 1 and 8 are 9; 8 and 1 are 9. If the 18 be placed under the 81 and added the sum is 99. If the figures be added thus, 1, 8, 8, 1, it will give 18. Reading from left to right it is 18, and 18 is two-ninths of 81. By adding, dividing, and multiplying 19 9s are produced, being one 9 for each year required to complete the century.

A CURIOUS GRAVE.

The practice of burning the dead was common among the ancients, and was in vogue during the first two centuries of the Christian era. In Italy, the ashes of the dead were generally buried in the ground or deposited in vaults, while among the Celtic people inhabiting Gaul and Britanny the urn was frequently inclosed in terra cotta globes and then



interred. One of these spherical graves is shown in the engraving; it was discovered near Lincoln, England, by the Rev. John Carters. The globe is roughly made of terra cotta. It has a diameter of several feet, and contains an urn, the shape of which indicates its Roman origin. As at that period Roman legions occupied England, the ashes are probably those of a soldier from the Gallic provinces. The urn is made from white clay.

Treatment of Whooping Cough in Gas Works.

According to the *Lancet*, a series of recommendations on the treatment of whooping cough in gas works has been made to the French *Académie de Médecine*. Some time ago a committee of three was appointed to investigate the subject, and of these M. Roger, the President of the Académie, is the sole survivor. He has lately presented a report which is of considerable interest. Before considering the communication, he described the arrangement of the chambers for purifying the gas, and the chemical products which patients would breathe therein. The purifying chamber is a large room with doors and windows freely open. Each contains twenty-four vessels, holding five cubic meters of depurating substance—lime and sulphate of iron, mixed with sawdust—through which the gas has to pass. When the workmen are emptying and refilling these vessels the children with whooping cough are placed around it, and inhale the vapors which escape. They are in an atmosphere containing ammonium sulphide, carbolic acid, and tarry products. As to the efficacy of the treatment, M. Commenge records 120 cases in which the treatment was persevered with. In 20 the treatment failed completely, in 48 improvement followed, and 101 were cured. M. Bertholle merely states that of 341 cases 122 were improved and 219 were cured. Failures or deaths are not mentioned. Besides the 490 cases improved there were, it appears, 671 cases not included, because the treatment was not persevered in, and these perhaps include a large number of failures. The remote situation of most gas works, and the exposure involved in the treatment in winter, must necessarily limit the application of the method. M. Roger thinks that it acts only upon one element of whooping cough—the catarrh—and that it is contra-indicated in febrile attacks of the disease, and would be dangerous in complicated cases. The method, however, is easy of use in some localities in summer, and seems worthy of further trial in suitable cases.

MISCELLANEOUS INVENTIONS.

Mr. Abraham Witmer, of Safe Harbor, Pa., has patented an improved car starter. Coiled springs are engaged by clutches operated by the wheels when the car is stopped, and the springs thus being wound up, the momentum of the car is stored up as a force to assist the subsequent starting. Means for placing this arrangement under the control of the driver or conductor of the car are provided.

Mr. Wallace H. Phelps, of Alliance, Ohio, has invented an improved drill for coal. It is a large auger provided with a peculiar screw feed and means for holding it in adjustment, and the bits or cutters are formed of S-shaped cutting knives formed with cutting edges at both ends. The shape of these knives renders them effective and durable.

A curious combination of water races with gates at different heights, water wheels, tanks, and pumps, has been patented under the title of "water power," by Mr. Robert Thamm, of Oshkosh, Wis., by which means the water can be made to act upon a single motor, or a series of motors, the water acting successively upon the motors in the order of their elevation.

A patent for a spark arrester has been granted to Messrs. Geo. Gunther, of Bath, N. Y., and William Kowalski, of Brooklyn, N. Y. The lower part of the smokestack has a jacket, and the upper part of the stack is attached to the lower part by brackets. In the upper part of the stack is placed a deflecting cone with its apex downward over the opening in the lower part. The blast is turned outwardly and downward, and a portion of it emerges through the opening between the two parts of the stack, while the sparks are retained in a space between the upper and lower parts, the lower part projecting upward into the upper part.

Mr. Jonathan Cornell, of Sandy Hill, N. Y., has patented an improvement in paper pulp washers, which washes the pulp faster than strainers constructed in the ordinary manner, and enables the operator to see into the washers to watch the progress of the work, and to clean the strainers when necessary by water discharged through a hole against the inner surface of the strainers.

Mr. Oley C. Hanson, of Eureka, Cal., has patented an improved shingle machine, in which, by a peculiarly constructed carriage for conveying the block to the saw, a novel sliding crank feed mechanism and a device for changing the lead of the saw, he secures simplicity of construction, speed, and regularity in the operation of the machine.

A rectilineal motion of sulky plows is secured in an invention patented by Mr. Samuel H. Taylor, of Kansas City, Mo. Bars with lateral slots form the connection of the plow to the sulky shaft, which permits the draught pole of the sulky to oscillate laterally without affecting the direction of the plow, which can be raised or lowered at will by the operator.

Messrs. George Biehn and Rudolph Weidauer, of Racine, Wis., have patented an improved band cutter for thrashing machines so constructed as to cut the bands rapidly and surely and deliver the grain in good condition to the feeder. The feeder is protected from being accidentally cut by the knife of the band cutter.

An improved heel for boots and shoes, patented by Jean Leycuras, of Paris, France, provides improved means for mounting the heels upon the shoe, secures increased solidity and greater rapidity in manufacture, and completely masks nails, screws, and threads. The heel is provided with a circumferential groove, and the upper leather is secured at its edge in the groove by nails driven from the outside. An overlapping edge, or strip of leather, is arranged to turn up over and mask the nail heads.

Fires in Coal Mines.

A vein near Coal Castle, Schuylkill County, has been burning for forty-five years. A huge fire was kept in a grate at the mouth of this mine to prevent the water in the gutters from freezing. One night, in 1835, the timbers of the drift caught fire, and when discovered the flames were beyond control, and the mine was abandoned. Many efforts have been made since to work the mine, as the coal was of remarkably good quality; but although it has been flooded many times, the fire continues to rage, and the intense heat makes it impossible for miners to labor even in slopes which were opened some distance from the burning vein. No vegetation grows on the surface above this pit of fire, and it is dangerous to walk across it, as many places have caved in, and there seems to be but a thin shell of earth over it. Near Mauch Chunk there is Summit Hill Mine, which has been burning for about twenty-five years, and vast sums of money have been expended in fruitless efforts to extinguish the flames.

Quillaia Toothwash.

BY ALEXANDER E. BENNETT, PH.G.

An excellent toothwash containing glycerin is made as follows: ℞. Soap bark, ground, 4 ounces; glycerin, 3 ounces; diluted alcohol, sufficient for 2 pints; oil of gaultheria, oil of peppermint, āā 20 drops.

Macerate the soap bark in the mixture of glycerin and diluted alcohol for three or four days, and filter through a little magnesia previously triturated with the volatile oils.

Thus made, a much better preparation is obtained than by macerating the bark in the dilute alcohol, and adding the glycerin afterward.—*American Journal of Pharmacy.*

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[New York Tribune.]

Interesting Tests Made by the Government Chemist.

Dr. Edward G. Love, the present Analytical Chemist for the Government of the United States has recently made some interesting experiments as to the comparative value of baking powders. Dr. Love's tests were made to determine what brands are the most economical to use. And as their capacity lies in their leavening power, tests were directed solely to ascertain the available gas of each powder. Dr. Love's report gives the following:

"The prices at which baking powders are sold to consumers I find to be usually 50 cents per pound. I have therefore calculated their relative commercial values according to the volume of gas yielded on a basis of 50 cents cost per pound."

NAME OF THE BAKING POWDERS.	AVAILABLE GAS. CUBIC INCHES PER EACH OUNCE POWDER.	COMPARATIVE WORTH PER POUND.
"Royal" (cream tartar powder)	127·4	50 cts.
"Patapsco" (alum powder)	125·2	49 "
"Rumford's" (phosphate) fresh	122 5	48 "
" " old	32·7	13 "
"Hanford's None Such"	121·6	47¾ "
"Redhead's"	117·0	46 "
"Charm" (alum powder)	116·9	46 "
"Amazon" (alum powder)	111·9	44 "
"Cleveland's" (short weight ¾ oz.)	110·8	43 "
"Czar"	106·8	42 "
"Price's Cream"	102·6	40 "
"Lewis's" condensed	98·2	38½ "
"Andrews' Pearl"	93·2	36¾ "
"Hecker's Perfect"	92·5	36 "
Bulk Powder	80·5	30 "
Bulk Aerated Powder	75·0	29 "

NOTE.—"I regard all alum powders as very unwholesome. Phosphate and tartaric acid powders liberate their gas too freely in process of baking, or under varying climatic changes suffer deterioration."

[New York Tribune.]

Alum Baking Powders in Court.—Interesting Testimony of Scientific Men.

Within the past two years a bitter controversy has been waged between manufacturers, on account of the use of alum as a cheap substitute for cream of tartar, by many manufacturers of baking powders. The handsome profits yielded by using the substitute haye induced dealers as well as manufacturers to push them into the hands of consumers, sometimes under definite brands, frequently by weighing out in bulk without any distinguishing name.

Are such powders wholesome? The Royal Baking Powder Co., who make a cream of tartar baking powder, declared that they are injurious to the public health, while others who make alum powders claim that they are not. The whole matter as to the effects of these alum powders has finally been brought into the courts, and the case was tried in the Superior Court of New York city before Chief Justice Sedgwick, reported substantially as follows in the New York *Sun:*

CONCLUSION OF A LITTLE TROUBLE BETWEEN A CHEMIST AND AN EDITOR.

The suit of Dr. Henry A. Mott against Jabez Burns, has brought to light the fact that this country produces at least forty-two different kinds of baking powders. Neither Burns nor Mott has been found guilty of making the baking powders, but Burns, who is the editor of a periodical called the *Spice Mill*, has been severely mulcted for libel in his efforts to make his paper spicy. Dr. Mott, it appears, is a chemist, and at one time was employed by the United States Government to analyze different specimens of baking powder which had been recommended for adoption to the Indian Bureau. Dr. Mott reported in favor of the cream of tartar baking powders for the Indians, and against the alum baking powders. The chemist analyzed forty-two kinds of baking powders.

The jury were out about half an hour. Then they came in with a verdict awarding Dr. Mott $8,000, to which the Court made an additional allowance of $150.

As the public have a large interest in the wholesomeness of whatever it is called upon to use as food, the following extracts are introduced from the testimony of some of the prominent men as to the injurious effects of alum powders:

DR. MOTT:

Q. Were you employed by the U. S. Government?

A. I was, sir; was employed as chemist, to analyze all the articles of food; to express an opinion as to the analysis of their healthfulness and purity.

Q. Please tell the jury the baking powders that you examined while in the employ of the government.

A. It would be difficult to remember them all; I could refer to my books; I examined twenty-eight powders; was given sixteen at first.

By the Court:

Give your best recollection.

Q. And one of the powders included was "Dooley's Baking Powder?"

A. Yes, sir.

Q. And the "Charm?"

A. Yes, sir; the "Charm" and "Patapsco."

Q. Please state in which powders you found alum.

A. I found alum in Dooley's "Patapsco," "Charm," "Queen," "Vienna," "Orient," "Amazon," "Lake Side," "Twin Sisters," "Superlative," "King," "White Lily," "Monarch," "One Spoon," "Regal," "Imperial," "Honest," "Economical," "Excelsior," "Chartres," "Grant's," "Giant."

Q. Recurring to the question that has been asked you upon this suit—the result of these examinations which you have made—is it your opinion that alum in these various compounds, in baking powders such as you have examined, is injurious?

A. It is my opinion, based upon actual experiments on living animals.

CHARLES F. CHANDLER, called on behalf of the plaintiff, being duly sworn, testified as follows:

Q. Dr. Chandler, you reside in the City of New York?

A. I do.

Q. Your business is that of a chemist?

A. It is.

Q. You are and have been Professor of Chemistry in several colleges?

A. I have.

Q. Please state how long that employment of yourself has been, and with what colleges you are now connected.

A. I am at present Professor of Chemistry in the Academic Department of Columbia College; the School of Mines, Columbia College; the New York College of Physicians and Surgeons, and the New York College of Pharmacy.

Q. You are President, also, of the Board of Health, are you not?

A. I am.

Q. In your various employments, have you had frequent occasion to examine the question of the wholesomeness of food, and the beneficial or injurious effects of its ingredients?

A. I have.

Q. I will ask you in regard to the use of alum with soda, in a baking powder, whether or not it is neutralized—is there any injurious constituent of alum left?

A. There is an injurious constitutent left after the mixture of alum and bicarbonate of soda.

Q. Without using any nicety of chemical terms, what is your opinion about the use of alum in a baking powder, in combination with bicarbonate soda and other ingredients, for raising bread—whether injurious or not?

A. I think it is dangerous to the digestive organs, and liable to produce serious disturbance of the liver of the individual making use of such powders.

HENRY MORTON, President of "Stevens Institute," called in behalf of the plaintiff being duly sworn, testified as follows:

Q. You are President of Stevens Institute?

A. I am.

Q. And have for many years been a chemist?

A. I have.

Q. Have you had occasion to examine the substances which are used in the composition of baking powders?

A. I have.

Q. Did you, some time ago, examine a sample of Dooley's Baking Powder?

A. I did.

Q. Is that it, sir? [handing can].

A. Yes, sir; that is it.

Q. Well, what kind of alum did it contain?

A. It contained potash alum.

Q. Did you make any extract of that alum, to show the kind?

A. I did; I extracted a large quantity of it as potash alum, and it is in that bottle which I have now here [showing bottle]; that is potash alum which came out of the alum baking powder that was in that can.

Plaintiff's Counsel offers said can of Dooley's Baking Powder in evidence.

Q. Now, sir, have you made any experiment in the bread made from baking powder, to see whether there was any soluble alumina in the bread itself?

A. I have; I took a portion of this powder and mixed it with flour in the directed proportions, and baked a small loaf with it; then I soaked this loaf—the interior part of it—in cold water, and made an extract, in which I readily detected, by the usual tests, alum—that is, alumina in a soluble condition.

Q. Does any baking powder in which any alumina salts enter, contain alumina, in your opinion, which can be absorbed in the process of digestion—are not such objectionable?

A. Very decidedly objectionable, in my opinion.

Q. Why do you say—from what system of reasoning do you make it out—that because alum is injurious, alumina is injurious?

A. Because the injurious effects of alumina, when it gets into the stomach and reacts on the organs, are the same; this hydrate of alumina meets in the stomach the gastric juices, and reacts with them the same as alum would; it forms, in fact, a kind of alum in the stomach with those acids, and whatever alum would do, it would do.

Dr. SAMUEL W. JOHNSON, Professor of Chemistry in the Scientific School, Yale College, being duly sworn, testified as follows:

Q. You have had much to do in the examination of substances that enter into food, and the adulteration of food?

A. More or less; yes, sir.

Q. After the use of alum with soda, in a baking powder, in your opinion, is there any injurious substance left?

A. In my opinion, there is an injurious substance left.

Q. What, sir, two years ago, was the prevailing opinion among scientific men, as to the effect of the use of alum in baking powders?

A. As far as my acquaintance with scientific men is concerned, my personal opinion is derived from my investigation and from reading; I should think the opinion was that alum, or any compound of alumina, would be decidedly injurious.

Q. Do I understand you to say that any baking powder in which there are aluminous salts, or any resultant from alum which could be absorbed in digestion, is objectionable and injurious?

A. Extremely so.

Prof. JOSEPH H. RAYMOND called, sworn and testified as follows:

Q. Would you be good enough to state your profession?

A. I am a physician, sir, and a professor of physiology.

Q. You also were, and have been for some time, Sanitary Superintendent in Brooklyn—is not that so?

A. I have, sir.

Q. Now, sir, I will ask you your opinion, from this experience, whether the use of alum with soda, in a baking powder, is injurious or not, in its physiological effects?

A. I consider it to be dangerous.

Q. You examined this question for the Board of Health in Brooklyn, some years ago, did you not?

A. Two years ago, sir, in December.

By the Court:

Q. What was the result of your investigation as to the use of alum in baking powder?

A. The result of my investigation at that time was this: that the changes which took place between the time that alum baking powder was put in the bread, and the time the bread was eaten, the chemical changes were so little understood by chemists, that as a physician and physiologist, I considered it a dangerous experiment.

Dr. Mott, the Government chemist, in his review on the subject in the SCIENTIFIC AMERICAN, makes special mention of having analyzed the Royal Baking Powder, and found it composed of pure and wholesome materials. He also advises the public to avoid purchasing baking powders as sold loose or in bulk, as he found by analyses of many samples that the worst adulterations are practiced in this form. The label and trade mark of a well known and responsible manufacturer, he adds, is the best protection the public can have.

DECISIONS RELATING TO PATENTS.

United States Circuit Court.—Northern District of New York.

UNITED STATES STAMPING COMPANY *vs.* JEWETT *et al.*

Blatchford, J.:

1. Patent to E. A. Heath, No. 119,705, granted October 10, 1871, not anticipated by invention of Weber, the proofs failing to show beyond a reasonable doubt that Weber was prior to Heath.

2. Where the decree in a former suit against one license of a patentee was for a simple dismissal of the bill a claim that the plaintiff is estopped from suing another licensee will not be entertained.

3. Where a patent has been allowed and ordered to issue, and an assignment has then been made authorizing the Commissioner to issue patent to assignee, and patent issue to inventor, the assignment not having been recorded until after the issue of the patent, *Held* that the legal right to the patent became vested in the assignee on the recording of the assignment.

Our Trade with China.

Recent official reports show an encouraging increase in American trade with China, whose vast and undeveloped markets offer enormous opportunities for our manufacturers and farmers.

A few years ago wheaten bread was all but unknown in China. The multitudes of returning Chinamen carry home with them not only a knowledge of wheat but a preference for it. One steamship from San Francisco carried to China, last year, 1,400 tons of flour; and the entire shipment for 1879 was 235,789 barrels. The vast wheat fields of the Pacific coast are likely soon to find an ample market for their products among the millions of the Celestial Empire.

During the same year California found in China a market for half her quicksilver product, or 36,696 flasks. Of other products the total shipment from the country was not large, but the variety indicates great possibilities of future development. The exports to China for the year, the last for which official reports have been published, included clocks, to the value of $50,397; cottons, colored, $270,000; cottons, uncolored, $1,302,000; drugs and chemicals, $13,700; glassware, $14,000; silver bullion, $1,831,000; machinery, $9,000; other iron manufactures, $9,000; firearms, $17,000; lamps, $22,000; kerosene, $690,000; ordnance stores, $9,000; provisions, such as bacon and other meats, butter and cheese, etc., $42,000; refined sugar, $7,000; tobacco, $52,000; clothing, $10,000.

TO RENDER IVORY FLEXIBLE.—Ivory is readily rendered quite flexible by immersion in a solution of pure phosphoric acid (specific gravity 1·13) until it loses, or partially loses, its opacity, when it is washed in clean cold water and dried. In this state it is as flexible as leather, but gradually hardens by exposure to dry air. Immersion in hot water, however, restores its softness and pliancy. The following method may also be employed: Put the ivory to soak in three ounces nitric acid mixed with fifteen ounces water. In three or four days the ivory will be soft.

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Business and Personal.

The Charge for Insertion under this head is One Dollar a line for each insertion; about eight words to a line. Advertisements must be received at publication office as early as Thursday morning to appear in next issue.

Ladies who board or live in hotels, will do well to secure one of Frothingham & Emery's Patent Portable Safety Jewel Cases. Attachable to bureau drawers, etc., keeping secure jewelry and ornaments from dishonest domestics. Manufactured at 20 Vesey St., New York city. See advertisement on last page.

For Sale.—A 10 H. P. Wood and Mann Portable Engine and Boiler, in good condition. The E. Ingraham & Co., Bristol, Conn.

Books for Engineers and Mechanics. Catalogues free. E. & F. N. Spon, 446 Broome St., New York.

Repairs to Corliss Engines a Specialty. L. B. Flanders Machine Works, Philadelphia, Pa.

Driving Clocks for Equatorial Telescopes. Address Th. Fischlein, 158 Pavonia Ave., Jersey City, N. J.

Inventors, Attention.—Apparatus wanted to discharge coal barges by steam shovel instead of hand shoveling. R. C. Hebener, 24 Exchange Place, Boston, Mass.

The greatest attraction at the last Am. Inst. Fair was the Cider Press of Messrs. Boomer & Baschett, where it was in daily operation. New York Office, 15 Park Row.

For Sale.—A Valuable Patent Invoice File and Holder, including dies and formers necessary for the manufacture of same. Sample file, 50 cts. Terms and circulars free. Moore, Patterson & Co., Saltsburg, Pa.

Wanted—State and County Agents to introduce a New and Valuable Patent. Address, with references, Box 43, Lake Forest, Ill.

Send to John D. Leveridge, 3 Cortlandt St., New York, for illustrated catalogue, mailed free, of all kinds of Scroll Saws and Supplies, Electric Lighters, Tyson's Steam Engines, Telephones, Novelties, etc.

Wanted—Second-hand Iron Planer, 6 foot bed, plane 16 to 24 in. wide. Must be in best order. Give maker's name, weight, and price. Moseley & Co., Elgin, Ill.

Wanted—An experienced Mechanical Engineer as Superintendent. One well known to the trade and competent to estimate. Give reference, and address Atlantic Steam Engine Works, Brooklyn, N. Y.

Wanted—Second-hand Root Blower. S. Moulson, Rochester, N. Y.

American Inventions Wanted to Sell Abroad. Address J. R. Fox, 50 St. Aubyn St., Davenport, England.

Why risk boiler explosion from mud? It can be avoided, at nominal cost, by Hotchkiss' Mechanical Boiler Cleaner, 84 John St., N. Y. Engineers make ten per cent selling other parties than employers. Send for circular.

Saunders' Pipe Cutting and Threading Machines. See adv., p. 45.

Abbe Bolt Forging Machines and Palmer Power Hammer a specialty. Forsaith & Co., Manchester, N. H.

List 25.—Descriptive of over 2,000 new and second-hand machines, now ready for distribution. Send stamp for same. Forsaith & Co., Manchester, N. H.

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Within the last ten years greater improvements have been made in mowing machines than any other agricultural implement. It is universally acknowledged that the Eureka Mower Co., of Towanda, Pa., are making the best mower now in use, and every farmer should write to the manufacturers for catalogue, with prices.

Eureka Vegetable Boiler Scale Eradicator, strictly vegetable, and perfectly harmless to iron. Warranted to remove scale of any thickness, and to prevent scaling from either fresh or salt water use. Circulars and particulars of G. E. Brinckerhoff, 107 Liberty St., N. Y.

For Machinists' Tools, see Whitcomb's adv., page 28

Jenkins' Patent Valves and Packing "The Standard." Jenkins Bros., Proprietors, 11 Dey St., New York.

Presses & Dies. Ferracute Mach. Co., Bridgeton, N. J.

Superior Malleable Castings at moderate rates of Richard P. Pim, Wilmington, Del.

Wood Working Machinery of Improved Design and Workmanship. Cordesman, Egan & Co., Cincinnati, O.

The "1880" Lace Cutter by mail for 50 cts.; discount to the trade. Sterling Elliott, 262 Dover St., Boston, Mass.

The Tools, Fixtures, and Patterns of the Taunton Foundry and Machine Company for sale, by the George Place Machinery Agency, 121 Chambers St., New York.

Experts in Patent Causes and Mechanical Counsel. Park Benjamin & Bro., 50 Astor House, New York.

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Malleable and Gray Iron Castings, all descriptions, by Erie Malleable Iron Company, limited, Erie, Pa.

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National Steel Tube Cleaner for boiler tubes. Adjustable, durable. Chalmers-Spence Co., 40 John St., N. Y.

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Lightning Screw Plates and Labor-saving Tools, p. 60.

4 to 40 H P. Steam Engines. See adv. p. 45.

National Institute of Steam and Mechanical Engineering, Bridgeport, Conn. Blast Furnace Construction and Management. The metallurgy of iron and steel. Practical Instruction in Steam Engineering, and a good situation when competent. Send for pamphlet.

Eclipse Portable Engine. See illustrated adv., p. 30.

Nickel Plating.—Sole manufacturers cast nickel anodes, pure nickel salts, importers Vienna lime, crocus, etc. Condit. Hanson & Van Winkle, Newark, N. J., and 92 and 94 Liberty St., New York.

Clark Rubber Wheels adv. See page 29.

Reed's Sectional Covering for steam surfaces; any one can apply it; can be removed and replaced without injury. J. A. Locke, & Son, 32 Cortlandt St., N. Y.

Silent Injector, Blower, and Exhauster. See adv. p. 60.

The American Electric Co., Proprietors and Manufacturers of the Thomas Houston System of Electric Lighting of the Arc Style. See illus. adv., page 61.

Rollstone Mac. Co.'s Wood Working Mach'y ad. p. 29.

Fire Brick, Tile, and Clay Retorts, all shapes. Borgner & O'Brien, M'f'rs, 23d St., above Race, Phila., Pa.

See Bentel, Margedant & Co.'s adv., page 60.

Tyson Vase Engine, small motor, 1-33 H. P.; efficient and non-explosive; price $50. See illus. adv., page 60.

Use Vacuum Oil Co.'s Lubricating Oil, Rochester, N.Y.

Steam Hammers, Improved Hydraulic Jacks, and Tube Expanders. R. Dudgeon, 24 Columbia St., New York.

Diamond Planers. J. Dickinson, 64 Nassau St., N. Y.

50,000 Sawyers wanted. Your full address for Emerson's Hand Book of Saws (free). Over 100 illustrations and pages of valuable information. How to straighten saws, etc. Emerson, Smith & Co., Beaver Falls, Pa.

Frank's Wood Working Mach'y. See illus. adv., p. 60.

Peerless Colors—For coloring mortar. French, Richards & Co., 410 Callowhill St., Philadelphia, Pa,

Peck's Patent Drop Press. See adv., page 45.

For Pat. Safety Elevators, Hoisting Engines. Friction Clutch Pulleys, Cut-off Coupling, see Frisbie's ad. p. 60.

For Separators, Farm & Vertical Engines, see adv. p. 61.

Tight and Slack Barrel machinery a specialty. John Greenwood & Co., Rochester, N. Y. See illus. adv. p. 61.

Elevators, Freight and Passenger, Shafting, Pulleys and Hangers. L. S. Graves & Son, Rochester, N. Y.

For Patent Shapers and Planers, see ills. adv. p. 60.

For Heavy Punches, etc., see illustrated advertisement of Hilles & Jones, on page 61.

Comb'd Punch & Shears; Universal Lathe Chucks. Lambertville Iron Works, Lambertville, N. J. See ad. p. 60.

Blake "Lion and Eagle" Imp'd Crusher. See p. 45.

Mineral Lands Prospected, Artesian Wells Bored, by Pa. Diamond Drill Co. Box 423, Pottsville, Pa. See p. 60.

Wren's Patent Grate Bar. See adv. page 45.

For best low price Planer and Matcher, and latest improved Sash, Door, and Blind Machinery, Send for catalogue to Rowley & Hermance, Williamsport, Pa.

The only economical and practical Gas Engine in the market is the new "Otto" Silent, built by Schleicher, Schumm & Co., Philadelphia, Pa. Send for circular.

Penfield (Pulley) Blocks, Lockport, N.Y. See ad. p. 61.

Notes & Queries

HINTS TO CORRESPONDENTS.

No attention will be paid to communications unless accompanied with the full name and address of the writer.

Names and addresses of correspondents will not be given to inquirers.

We renew our request that correspondents, in referring to former answers or articles, will be kind enough to name the date of the paper and the page, or the number of the question.

Correspondents whose inquiries do not appear after a reasonable time should repeat them. If not then published, they may conclude that, for good reasons, the Editor declines them.

Persons desiring special information which is purely of a personal character, and not of general interest, should remit from $1 to $5, according to the subject, as we cannot be expected to spend time and labor to obtain such information without remuneration.

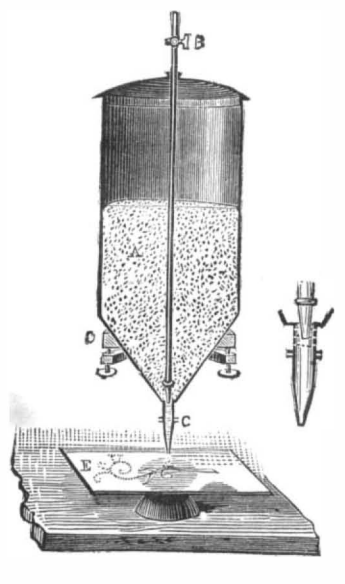
Any numbers of the SCIENTIFIC AMERICAN SUPPLEMENT referred to in these columns may be had at this office. Price 10 cents each.

(1) W. C. L. asks: Will a combination of coal gas and air confined in a chamber explode if exposed to heat? A. We have not heard of any instance of such an explosion having taken place without contact with a flame.

(2) W. W. G. asks: What is the scientific reason for the fact that the moons of Jupiter may be seen by reflecting his image in a common looking glass or mirror held horizontally, that is, the moons may be seen reflected in the glass? A. What are imagined to be the moons visible under such circumstances are not so in reality, but only a reduplicating of the body of the planet itself. The following are the optical principles involved in the formation of these false satellites: When the light from a luminous body falls upon a mirror held as described, two primary reflections reach the eye of the spectator, one from the first surface of the glass, the other from the back or silvered surface, which is much brighter than that from the outer surface. But this is not all. When the rays from the silvered side were being transmitted to the eye, part of them, when encountering the upper surface of the glass, were stopped, reflected back to the mirrored surface, to be again sent forward to the eye from a point different from those at which the two previous, or primary, reflections were made. The thicker the plate of glass the greater will be the separation of those images. This phenomenon may very easily be seen and studied by holding a plain piece of glass up on a level with the face, watching in it the reflected image of the flame from the gas or a lamp, when, if the glass is properly held, from four to eight or ten of these supplementary reflected images will readily be seen. This is usually designated "multiple reflection."

(3) C. H. B. inquires: What acid or other liquid will destroy or decompose any kind of wood with the greatest rapidity? A. Wood is chemically composed of two parts, lignin and cellulose. The walls of the vegetable cells are formed of the former; the filling matter of such cells by the latter. Lignin may be separated from wood in a pure state by boiling sawdust successively in alcohol, water, weak potash solution, dilute muriatic acid, and, finally, water. Lignin is not soluble in water, alcohol, ether, or oils; it is, however, soluble in strong nitric acid, which, on the other hand, has no action on the other constituent of wood, the cellulose, which is readily soluble in sulphuric acid, and by which it is converted into a substance similar to dextrine. From this the inference will at once be drawn that a solvent of wood must be composed of both acids. Whether these had better be employed in succession or mixed together in the form of nitrosulphuric acid, one or two experiments will determine, such experiments to be made on sawdust of any special kind of wood that our correspondent may have in his mind when putting the query.

(4) R. G. and others ask how to construct a simple and inexpensive sand blast apparatus for engraving glass and hard metals. A. Well dried sand, contained in the cylindrical vessel, A, is allowed to flow in a continuous manner through the tube, C, whose length and inclination can be altered at will, so as to regulate the fall of the sand. The tube conveying the current of air or steam terminates just above this spout, in a nozzle containing a series of fine holes. The sand, urged on by the jet, is thrown violently against the



glass plate, E, or other body placed within its range, and thus exerts an abrading action. By varying the quantity of the sand, the volume and the velocity of the current, as well as the diameter of the jet, more or less rapid effects are produced. Holes may be drilled in glass and in substances much harder than glass by means of this apparatus. In engraving on glass very little pressure is needed, the current from the bellows of an enameler's lamp being quite sufficient. In this way the divisions on graduated tubes, the labels on bottles, etc., can easily be engraved in laboratories with but little trouble. The portions of the glass which are to remain clear are covered with paper, or with an elastic varnish, these substances being sufficient protection against the abrading action of the sand.

(5) J. F. asks how to remove the hard burnt oil off the cylinder head of a steam engine. A. Try a small quantity of a strong solution of caustic potash in alcohol.

(6) W. H. W. asks if the oil that is caught by the cups under the hangers or journals can be used again. A. It should not be used again without purification. According to Simm's process the waste oil is dissolved out from the impurities by bisulphide of carbon filtered, and the bisulphide distilled off in a retort jacketed with hot water or steam, condensed and collected so that it may be used again for a similar purpose.

(7) H. C. G. asks how to color violins a dark cherry similar to the Cremonas, and how to prepare the stain and shellac. A. Stain—Dragon's blood 2 ounces, spirits of wine 1 quart. Digest with occasional agitation until dissolved. Varnish—Coarsely powdered gum copal and glass, each 4 oz.; alcohol, 1 pint; camphor, ½ oz.; heat the mixture with frequent stirring in a water bath so that the bubbles may be counted as they rise, until solution is complete, and when cold decant the clear portion.

(8) T. P. writes: In glazing sash, when the glass is crooked or convexed, which is the proper side to place next to the wood, the convex or concave side? A. The concave side, for the simple reason that the convex side gives the window a better appearance when placed outward.

(9) P. M. H. writes: I have a cast iron kettle that is cracked: how can I repair the damage? A. Sulphur, 2 parts; blacklead (plumbago), 1 part; melt the sulphur in an old iron pot over the fire, then add the blacklead, stir well together, and pour out on an iron plate or smooth stone. Apply with a hot iron after the manner of tinsmith's soldering.

(10) F. D. M. asks. Will water expand or contract in freezing? Will a water pipe burst when it freezes or when it begins to thaw out? A. Water contracts on cooling, but in congealing it expands. The rupture of water pipes is caused by the change of the water from the liquid to the solid state—not by the thawing, though it is only then that the damage to the pipe becomes apparent. Consult Tyndal's "Heat as a Mode of Motion."

(11) A. F. T. asks how to make jet black writing ink. A. Blue galls, 4½ oz; bruised cloves, 1 drachm; cold water, 40 oz; pure sulphate of iron, 1½ oz.; pure sulphuric acid, 35 minims; sulphate of indigo in the form of a thin paste, and which should be neutral or nearly so, ¼ oz; pure water, about 1 quart. Boil the galls gently in 1½ pint of water for an hour, adding water for what is lost by evaporation. Strain and squeeze the galls (in a press). Cool, filter, and add the iron salt dissolved in water and filtered; add the acid, agitate briskly, then add the indigo, shake, and filter. Improves by age.

(12) C. H. S. asks: What are the ingredients of the lightning stove polish sold by men on the streets? It is rubbed on with a cloth, requires no brushing, and gives a bright luster. A. Pure graphite, or plumbago, reduced to an impalpable powder by grinding and bolting.

(13) G. H. C. asks: What preparation (weighing much less than paint) will effectually waterproof a canvas canoe? A. Try paraffine mixed with ½ its weight of boiled oil. Melt by heat or dissolve in benzole.

(14) A. J. S. asks: Is there any air in pure water? If so, in what proportion; or how much to the gallon? A. All natural waters hold air in solution. The quantity is usually small and very variable.

(15) J. D. S. asks: 1. Can you inform me if there is to be had a mineral (or other) powder which will answer the following requirements, namely: Color a bright full yellow; insolubility in hot or cold water or sugar solution; an impalpably fine state of division as is seen in the best German ultramarine; not poisonous unless taken in quantities over ten grains? A. Reduce the deepest yellow glass, pure crown, free from lead, the color of which is due to silver, to impalpable powder by milling. Then pass it through a silk sieve. 2. Is there any way of preparing a cement of rubber or other gum which I could use to firmly attach two pieces of leather without impairing its pliability? It must be entirely waterproof and strong. A. See p. 2510, No. 158, SCIENTIFIC AMERICAN SUPPLEMENT.

(16) J. L. S. asks (1) for a receipt for a varnish or paste, or solution, by which to cover or saturate woolen felting to make it waterproof (against warm water) and at the same time remain pliable. A. *a*. Dissolve 1 part of pure gum rubber (caoutchouc) cut in shreds in about 20 parts of bisulphide of carbon free from dissolved sulphur. Pass the felting, first thoroughly dried, through this, then expose to the air until the smell of the solvent has disappeared. Do not use the solvent too strong—dilute with bisulphide. *b*. Paraffine, 10 parts; boiled oil, 2 parts; benzole (pure), 40 parts. Apply as above. 2. Also a receipt for a cement for cementing felting together. A. See marine glue—p. 2510, No. 158, SCIENTIFIC AMERICAN SUPPLEMENT.

(17) W. T. asks (1) how to prepare the silver solution in electro-silver-plating. A. Pure nitrate, 2½ ounces; cyanide of potassium (pure), 4¼ ounces; water, 1 gallon. Dissolve the cyanide in a portion of the water and the silver nitrate in another, mix well together until clear. 2. Is one cell of gravity battery sufficient for silver-plating small articles, such as spoons, forks, etc.? A. Hardly. The exposed surface of zinc should about equal the surface of the work in the bath.

(18) J. H. V. & Co. ask: Can you inform us of any solder with which we can mend small cast iron (2 oz.) castings with a heat that will melt hard solder? We find, by using common solder, the muriatic acid in a short time rusts under and lets the solder loose. A. Silver solder will answer your purpose, providing the fracture is clean and fresh. Paint the adjoining surfaces sparingly with borax ground to a fine cream on a slate or slab. Clamp or wire the joint firmly, and apply the silver solder in small pieces around the casting on the joint, sticking them with the borax cream. Heat in a charcoal fire or blow-pipe flame until the solder flows. If soft solder has been previously applied to the casting it cannot be soldered with silver solder. See soldering in SUPPLEMENT, No. 20.

(19) F. P. C. asks: 1. What is the best preparation to use on a stove pipe, to keep it from rusting? Something not very expensive, although durable, yet will not cause the pipe to burn out. A. Apply pure graphite (plumbago) ground to a very fine powder and mixed with a little water, then rub over with some of the same, dry. 2. Which is the best foot and power lathe, and where made—all things considered—for range of work, light running, moderate cost, durability, accuracy in the work without dead centers, something suitable for ordinary workshop or amateur varied work; screw cutting included? A. See our advertising columns, also "Hints to Correspondents." 3. Will pure virgin India-rubber, dissolved in about 8 or 10 times its own weight in benzole, do to mend boots? If serviceable, how should it be used? Should it be applied as varnish over the worn or damaged parts, or put under pressure with a suitable size to cover the defect or damaged part? And if pasted or cemented on under pressure, will it be serviceable? A. Yes; patch and put under moderate pressure until dry. 4. How are uppers on leather boots and shoes mended without using thread, etc.? Can a piece of leather, of suitable size, be pasted or cemented over the defective parts on the body of the boot or shoe, making a neat mend and also serviceable? A. See marine glue (second receipt), p. 2510, SCIENTIFIC AMERICAN SUPPLEMENT, No. 158; also rubber cement, same page.

(20) E. E. S. asks how to plate small articles of steel and brass with gold, silver, and nickel, without a battery. A. Gilding by dipping: Distilled water, 17 pints; pyrophosphate of potassa or soda, 28 ounces; solution of hydrocyanic acid (⅛ pure acid), ⅛ ounce; terchloride of gold, ⅜ ounce. Put 16 pints of the water in a porcelain or porcelain-lined iron vessel, and gradually stir in the pyrophosphate, heat, filter, and let it cool down. Add the gold chloride dissolved in water, and then the hydrocyanic acid. Heat the bath nearly to the boiling point for use. (Hydrocyanic acid, it must be remembered, is very poisonous, and it must be handled accordingly.) When heated the liquid becomes colorless. If a red or violet is developed, add a few drops more hydrocyanic acid. Clean the articles thor-

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oughly; dip them in a strong aqueous solution of mercurous nitrate, then. for a few seconds, in the hot gold bath, rinse in clear water, dry in warm sawdust, and burnish if desired. Silvering by dipping: To a saturated aqueous solution of bisulphite of soda in pure water add solution of nitrate of silver, with constant stirring, until the precipitate at first formed ceases to redissolve. Use the bath cold in a porcelain enameled iron vessel. Clean and dip as in the gold bath. We know of no satisfactory method of coating with nickel without a battery.

(21) R. M. asks for a receipt for making a gold and silver wash suitable for small brass articles. A. See answer to E. E. S., above.

(22) I. A. B. wants to know the cheapest and best deodorizer or deodorizing process for kerosene or petroleum. A. Hydrocarbon derivatives of petroleum —such as kerosene—possess a characteristic odor which cannot be totally removed without altering the identity of the substance. The unpleasant odor imparted to it by impurities which it commonly contains may be removed by the following treatment: Agitate it briskly with three per cent of oil of vitriol, wash out the acid with water; digest, with frequent agitation, for several hours with 5 per cent of clean, fresh chloride of lime. settle and wash out with water. Remove moisture by agitating with powdered chloride of calcium. Settle and decant.

(23) L. D. M. asks whether there is any law against turning out or filing off one side of United States gold and silver coins to make bangles of them, oragainst melting coins for the sake of the gold or silver. A. Section 5459 Revised Statutes, reads: "Every person who fraudulently, by any art, way, or means, defaces, mutilates, impairs, diminishes, falsifies, scales, or lightens the gold or silver coins which have been or which may hereafter be coined at the mints of the United States, or any foreign gold or silver coins which are by law made current or are in actual use and circulation as money within the United States, shall be imprisoned not more than two years and fined not more than two thousand dollars." We think this law prohibits the defacement of coins as in making bangles. We do not know of any provision that prohibits the melting of coins for the sake of the gold or silver.

MINERALS, ETC.—Specimens have been received from the following correspondents, and examined, with the results stated:

Dr. G. H. P.—It is quartz rock.—J. T. C. and O. L.—A fair quality of fire clay. See column of Business and Personal for the addresses of dealers.—J. T. S.—A poor quality of peat.—O. A. P. T.—The ore consists chiefly of carbonate and sulphide of copper—it carries a small quantity of silver.—F. G. D.—A semi-decomposed feldspathic rock, with a little quartz and talc.—D. Mc. G.—Coal shale—of no commercial value.—P. M. C.—Limestone—of no value to lithographers.—J. G.—Hematite—an iron ore.—W. St. J.—The rock is a common mica and talcose schist—not the "tin bloom" of miners. It would hardly pay to dig deeper.—C. H. G.—The crystals are smoky quartz—of very little economic value.—H. S.—Chiefly carbonate of lime—not valuable. —G. J. G.—Quartz pebbles.—J. F. S.—Ferromanganese—iron and manganese oxides.—H. T. C.—It is a fair quality of carbon black. If properly packed might command a market here.

NEW BOOKS AND PUBLICATIONS.

CHICAGO FIELD, 155 and 157 Dearborn street, Chicago, Ill. Dr. N. Rowe editor. An illustrated weekly devoted to field sports. Price $4 per year.

This journal, under the editorship of Dr. Rowe, has taken a foremost position among papers devoted to sport and sporting. It is well edited, and each week contains articles of much valuable information for lovers of dogs and horses. It is the only illustrated paper published in this country devoted to sports of the field, and is well worth its subscription price to those who are fond of out-door sports.

WAR SHIPS AND NAVIES OF THE WORLD. By Chief Engineer J. W. King. Boston: A. Williams & Co. 1880. 8vo, cloth, pp. 623. Sixty-six pages of engravings.

Mr. King has had exceptional facilities for making a thorough study of the naval progress of Europe during recent years, and has brought to the task a degree of practical experience and insight quite as exceptional. He entered the United States Navy when the steam marine was in its infancy, and served in the first paddle wheel frigate, the first screw war ship, indeed in all the pioneer naval steamers with the single exception of the Fulton. He has been Government Inspector of ocean mail steamers, and Chief Engineer of the New York Navy Yard. He was Chief Engineer of the North Atlantic fleet in the early part of the civil war, and subsequently was superintendent of the construction of all the armor clads built west of the Alleghanies. More recently he has been chief of the Bureau of Engineering. Most of the information embodied in the present work was gathered during several tours of observation abroad under orders from the government of the United States, made for the purpose of studying recent progress in naval architecture and the mechanical appliances for use in naval warfare. The result is a comprehensive treatise containing a vast range of fresh information touching the construction, motive power, and armament of modern warships, naval artillery, marine engines, torpedoes, and torpedo boats etc. The navies of all the naval powers are separately described, dwelling especially upon the changes in types of war ships, and in armor and armament made during the past decade. Much information is also given with regard to naval dock yards, methods of contracting for ships and machinery, naval administration, the personnel of navies, naval expenditures, and related matters. Extremely valuable also are the chapters on recent progress and improvements in artillery construction, the different systems of great guns, gun trials; armor plates and war ship materials and tests of them; the different systems of marine engines and boilers; steam and hydraulic stearing gear; torpedo explosives, torpedo warfare, and the like. The author's wide experience as an engineer has admirably fitted him for this part of his task. Though treating of difficult subjects he has successfully endeavored to set down the information given in a manner so clear that the non-technical reader will be easily able to follow him. The volume is particularly timely at this juncture, when the great problems of restoring our commercial and naval marine, and of providing for the defense of our coasts, are attracting the attention of our legislators and citizens.

CHRISTMAS BOOKS. By Charles Dickens, New York: I. K. Funk & Co. 2 vols. 8yo, paper. Each 25 cents.

A Christmas Carol, The Chimes, The Cricket on the Hearth, The Battle of Life, and the Haunted Man, with sixteen full page illustrations, printed on clear type, are here given for fifty cents. The books comprise Nos. 48 and 49 of the standard series, the excellent quality and extreme cheapness of which we have several times taken occasion to speak.

JOSH BILLINGS' COOK BOOK. New York: G. W. Carleton & Co.

A cent's worth of proverbial philosophy badly spelled, some poor engravings, and a few burlesque recipes as destitute of wit as they are of resemblance to English speech.

[OFFICIAL.]

INDEX OF INVENTIONS

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AND EACH BEARING THAT DATE.

[Those marked (r) are reissued patents.]

A printed copy of the specification and drawing of any patent in the annexed list, also of any patent issued since 1866, will be furnished from this office for one dollar. In ordering please state the number and date of the patent desired and remit to Munn & Co., 37 Park Row, New York city. We also furnish copies of patents granted prior to 1866; but at increased cost, as the specifications not being printed, must be copied by hand.

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English Patents Issued to Americans.

From December 24 to December 28, 1880, inclusive.

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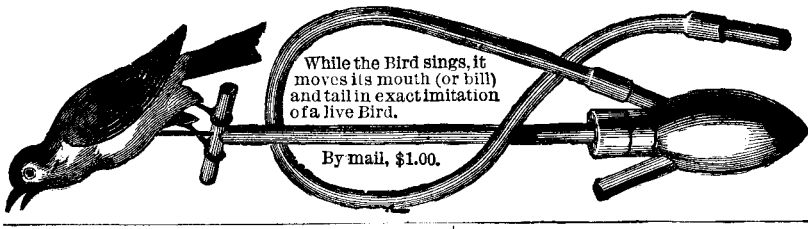

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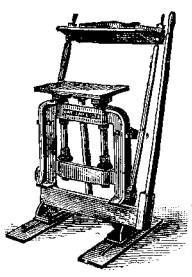

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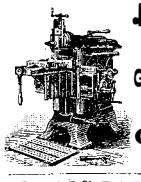

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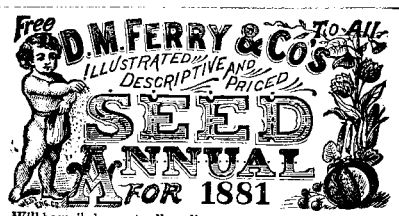

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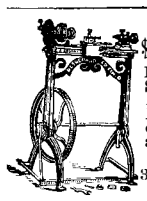

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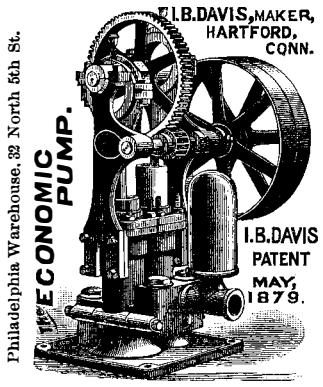
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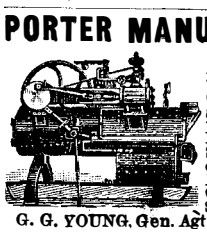

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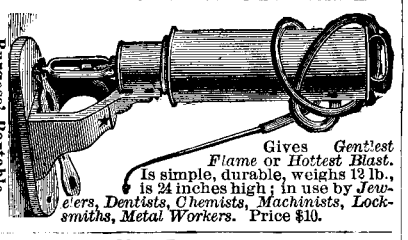

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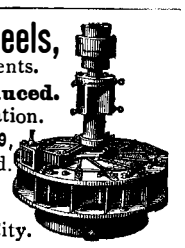

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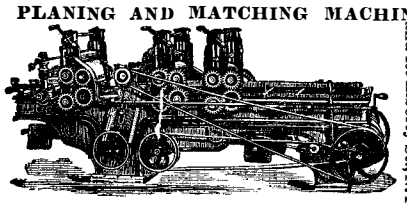

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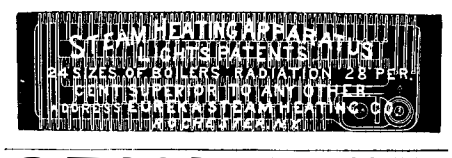
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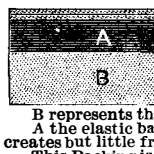

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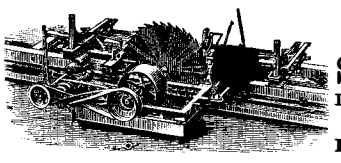

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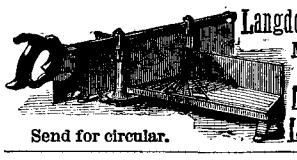

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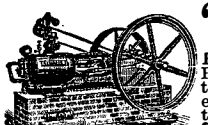

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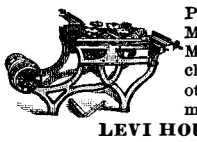

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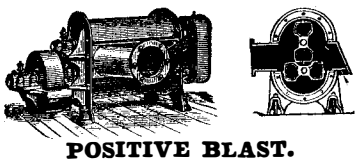

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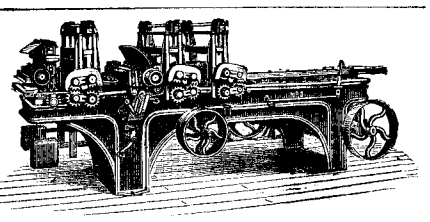

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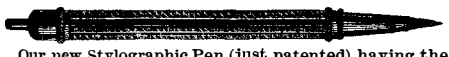

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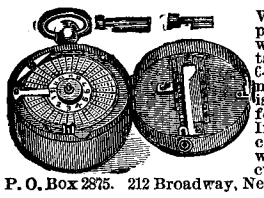

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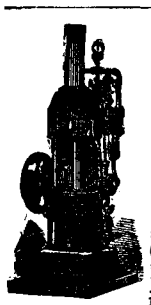

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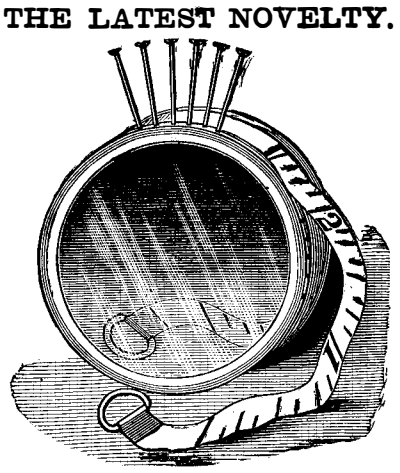

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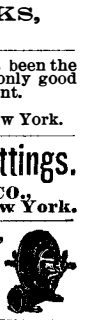

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